

SYSTEMS INTEGRATION  
FORECAST AND TRENDS

1988 - 1993

INPUT



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# SYSTEMS INTEGRATION FORECAST AND TRENDS 1988-1993

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**Systems Integration Program (SIP)**

***Systems Integration Forecast and Trends,  
1988-1993***

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# Abstract

Systems integration in the commercial sector is still relatively new, despite more than thirty years of application in the federal government sector. While there are differences between the two sectors, principally in the bidding process, the systems and services components have many similarities. A number of vendors in this market now have contracts in both sectors.

This report analyzes the U.S. systems integration market as it existed in 1988, examines the issues and trends that appear to affect the market, and forecasts its growth through 1993. The analyses include SI activities, driving forces, types of opportunities and leading vendors, by both vertical and cross-industry markets, by market share of leading vendors and by SI components. The components include information systems and communication hardware, packaged software, professional services, and other services.

The report also presents and analyzes user/buyer attitudes, vendor alliances, secondary market players and bidding procedures. Comparisons are provided with the 1986 U.S. Commercial SI Report and the 1988 Western Europe SI Report. Recommendations are made to vendors for addressing opportunities in this dynamic market.

The report contains 226 pages and 137 exhibits and was prepared as part of INPUT's Systems Integration Program.



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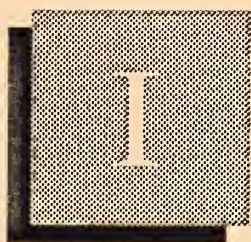
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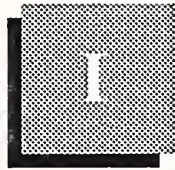


# Introduction









# Introduction

This market report, *Systems Integration—Forecast and Trends, 1988-1993*, has been prepared as part of INPUT's Systems Integration Planning Service (SIPS), now retitled the Systems Integration Program (SIP). The report identifies market and buyer issues and trends that affect systems integration (SI) vendors currently participating in and planning to enter the market. Both the commercial (CSI) and federal government (FSI) markets are analyzed with growth forecasted through 1993. Specific attention is given to the prospects of vertical industry and cross-industry markets, vendors active in those markets, and factors likely to impact market potential.

The SIPS/SIP was designed to assist INPUT's U.S. industrial clients in planning how to select and penetrate SI markets, to satisfy commercial and federal clients, and to identify which vendors occupy significant positions in the current industry. A separate report is being prepared to examine the competitors in the systems integration market, including profiles of leading SI vendors.

The report is based on interviews of SI clients for the INPUT reports on *Buyer Issues* and the *Systems Integration Report* (both in 1988), interviews of forecasters at the Department of Commerce, and reviews of data bases assembled by INPUT for the *Annual Information Services Industry Report*, *Federal Systems Integration Report*, and the earlier commercial systems integration reports.

## A Scope

The period covered in this report includes calendar years 1988 through 1993. The forecast, analysis and recommendations address the U.S. market, but include references from the recently released INPUT reports, *Commercial Systems Integration—Western Europe* and *Federal Systems Integration Market, 1988-1993*.

## 1. Geographic Coverage

The report addresses contracted systems integration projects implemented by U.S. vendors for U.S. business and governmental units. Some estimates of the current and future in-house integration projects are provided, on the basis of Department of Commerce capital equipment investment data reports from industry. The principal measure of growth is client expenditures, which are singular per client, and avoids the potential for double counting when using reported vendor revenues.

## 2. Systems Integration Definition

INPUT is using the SI Market Definition of Exhibit I-1 in all aspects of the 1988 SIPS as well as in this report. The emphasis is on provision of a complete solution and full-risk assumption by the prime SI contractor.

EXHIBIT I-1

### SI MARKET DEFINITION

- Complete solution to a complex information systems, networking, or automation requirement
  - Custom selection of products and services
  - Single point of contact and responsibility

Typically, the integrator provides project management and “start-to-end” responsibilities for systems design, provision, and/or development of all hardware, software, and communications systems; coordination of teaming arrangements with outside suppliers of engineering, data processing, and personnel resources; and the documentation, training, and post-implementation support required by the client (see Exhibit I-2).

In assuming the responsibility and the risk, the SI vendor warrants the success of the system, essentially guaranteeing that it will operate as promised, by an agreed delivery date, and at a predetermined cost.

## EXHIBIT I-2

**TYPICAL TASKS OF SI PROJECTS**

- Total project management
- Process feasibility and tradeoff studies
- Systems design
- Selection/configuration of hardware and network
- Selection of systems software
- Selection/development of applications software
- Installation of hardware and software
- Systems integration (hardware and software)
- Testing and demonstration of system
- Documentation
- Client staff training
- Operation and maintenance of hardware and software
- Financing

**3. Report Parameters**

The following characteristics are typical of the complex, information systems projects that SI is applied to and that serve as the bases of the forecasts included in this report:

- Projects are usually multiyear efforts.
- Projects have significant project management demands.
- Target systems are strategically significant to the client's information environment.



- These systems require significant portions of the software to be custom developed and/or include a substantial network requirement.

#### 4. Industry Market Sectors

The systems integration market was analyzed through segmentation of business and government into 14 industry-specific sectors and 7 cross-industry sectors shown in Exhibit I-3. The industry segmentation is based on the U.S. Department of Commerce SIC (Standard Industrial Classification) codes. Appendix B provides the SIC codes at the two-digit level and the way they map into INPUT's industry-specific segmentation.

EXHIBIT I-3

INDUSTRY MARKET SECTORS	
Industry-Specific Sectors	Cross-Industry Sectors
Discrete Manufacturing	Accounting
Process Manufacturing	Education and Training
Transportation	Engineering and Scientific
Utilities	Human Resources
Telecommunications	Office Systems
Wholesale Distribution	Planning and Analysis
Retail Distribution	Automation
Banking and Finance	
Insurance	
Medical	
Services	
State and Local Government	
"Other" (Education, Agriculture)	
Federal Government	

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**B****Organization**

This report, *Systems Integration—Forecast and Trends, 1988-1993*, is organized as follows:

- Section II, Executive Summary, provides an overview of the report and highlights the most significant information.
- Section III, Market Analysis and Forecast, defines the structure of the market, analyzes marketplace and competitive factors, and forecasts five-year growth by component, industry, and market share.
- Section IV, Vertical Industry Markets, analyzes the impact of industry forces, potential trends and opportunities, and forecasts each of the 14 industry-specific markets.
- Section V, Project Data Base Analysis, examines the distribution of projects in the 1988 data base by a variety of segments and technologies.
- Section VI, Market Strategies and Recommendations, focuses on the key steps vendors should consider to win SI projects.
- Appendix A includes INPUT definitions.
- Appendix B provides the standard industrial classification codes for industry segments.

---

**C****Methodology**

The data for this report was derived from several sources and assembled into a matrix of industries, project types, vendors, etc. The sources and data obtained were as follows:

- Data was derived from the data base of interviews with companies that have been or are now in the process of implementing large, complex systems acquired for the *1988 Systems Integration Project Reports* and identified as the SIPR Data Base.
- The 1986 CSI market forecast was updated by information from the U.S. Department of Commerce, and comparisons with the SIPR Data Base. The earlier forecast had been derived by the following steps:
  - The number of establishments, by industry, capable of supporting a major project effort were estimated, based on INPUT's knowledge of current activity in CSI and the U.S. Department of Commerce list of firms in the SIC codes.

- The percent of these companies that might actually have major projects in any year was then estimated and tested by the interviews. The number of possible projects based on the sample was calculated.
- The average dollar value of these major projects was estimated based on current CSI contracts, and the average value grown at a nominal rate including INPUT's inflation factors.
- The yearly proportion of the total dollar value to be contracted vendors was estimated using the assumptions of Exhibit I-4. From this the total CSI contract value in any one year was calculated.

To spread the contract over the life of the project, INPUT assumed an average project life of three years for development and, for simplicity, placed the outyear expenditures (i.e., ongoing support, operation, and maintenance) into the fourth year.

By industry, INPUT estimated the proportion of the total project dollars that would be spent on each component and calculated the percent of the total to be expended in each of the four years of the project. Growth rates for 1986 and 1987 were based on the 1986 forecast.

Dollars to be spent in each year on each component were calculated by multiplying the proportion of the total project to be allocated to each component by the total value of the contracts for the appropriate year.

- The range of values and growth rates of the industry-specific and cross-industry sectors, and project components were estimated as follows:
  - The range of contract values in the SIPR Data Base for each vertical industry was compared to the 1986 model and the forecasts of the 1988 INPUT Information Industry Survey to develop new estimates of sector growth rates.
  - Component estimates were also compared to those in the SIPR Data Base to modify the 1986 model and then cross-correlated to vendor estimates and the industry sector data.
  - Market shares were derived from interviews with vendors conducted by INPUT in 1988 for the *Annual Information Industry Survey* and the new *Systems Integration Competitive Analysis* report to assemble calendar 1988 data or best estimates of analysts.
  - Details on project composition were also derived from the SIPR Data Base and used to estimate technology utilization, infrastructure integration, and system trends.

## EXHIBIT I-4

### TYPICAL SI CONTRACT YEARLY EXPENDITURES

	Percent			
	Year 1	Year 2	Year 3	Year 4
Computer hardware	-	100	-	-
Communications hardware	-	-	100	-
Systems software packages	-	100	-	-
Applications software packages	-	-	100	-
Consulting	60	20	20	-
Project management fees	40	20	20	20
Design/integration	45	35	20	-
Software development	-	50	50	-
Education/training and documentation	-	-	33	67
O & M	-	-	33	67
Other	-	-	-	100

## D

### Economic Assumptions

In developing the five-year forecast, INPUT has incorporated the following economic assumptions regarding the outlook for the total U.S. economy and the impact on the systems integration delivery mode.

INPUT's forecasts are all in current dollars, which means that inflationary impact is included in the future years' figures.



INPUT projects a slowing in real GNP growth over the next two to three years as shown in Exhibit I-5. Real GNP growth is projected to decrease from a 3.8% annual rate in 1988 to a range of 2.5% to 2.8% over the next three years—before returning to about 3% in 1993. In addition, the inflation rate, as measured by the GNP deflator, is expected to increase modestly between 1988 and 1989, and then stabilize at a level in line with the current estimate of 4.5% for 1988.

## EXHIBIT I-5

### GNP NOMINAL GROWTH RATE ASSUMPTIONS (Percent)

	1987A	1988A	1989E	1990E	1991E	1992E	1993E
Real GNP	3.4	3.8	2.8	2.5	2.8	3.0	3.0
*GNP deflator	3.3	3.4	5.5	5.0	5.0	4.5	4.5
Nominal GNP	6.7	7.2	8.3	7.5	7.8	7.5	7.5

\*Year-to-year comparisons

A = Actual

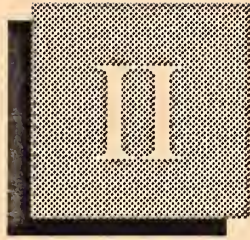
E = Estimate

Primary expectations affecting INPUT's outlook for nominal GNP growth rates over the next five years include an ongoing slowdown in consumer spending (related to modest increases in real consumer income); further slowing in the rate of increase in federal defense spending (related to the need to reduce the federal budget deficit); product-cycle maturation in certain key technology sectors, such as the low end of the personal computer market and in minicomputers; and higher interest rates, particularly in the near term, reflecting pent-up inflationary cost pressures.

Historically, the information services industry has been more resilient to slowdowns in real GNP growth (reflecting unit shipments) than have companies in the electronic components and equipment sectors. However, the ability to pass on inflationary pricing pressures is more varied in the information services industry. Factors influencing the ability to pass along inflation will include: the competitive structure of the industry, the nature of the client-vendor relationship, the labor-equipment mix, and the maturity of the specific industry subset.

**E****Related INPUT  
Reports****Annual Market Analysis***Information Services Industry Report* 1988*Information Services Industry-Specific and  
Cross-Industry Markets* 1988**Industry Surveys***Directory of Leading U.S. Information Services Vendors* 1988**Market Reports***Buyer Issues Report* 1988*European Systems Integration Trends and Opportunities* 1988*Systems Integration Project Reports* 1988*U.S. Professional Services Market, 1988-1993* 1988*U.S. Software Products Market, 1988-1993* 1988*Federal Systems Integration Market* 1988*Federal Office Information Systems Market, 1988-1993* 1988*Federal Professional Services Market, 1988-1993* 1988*Federal Software Market, 1987-1992* 1987*Network Integration* 1987*Commercial Systems Integration Implementations* 1987*Commercial Systems Integration Markets, 1986-1991* 1986



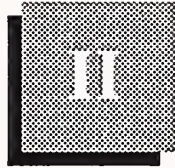


# Executive Overview









## Executive Overview

### A

#### Major Buyer Issues

Executive management in both the commercial and government sectors is emphasizing the role of information resources in meeting increasing demands for service. Improvements in the current systems and services will require integration of data, text, and images in real time. Management believes that new technologies will help them achieve optimum operations solutions. Exhibit II-1 illustrates the major buyer issues in 1988.

EXHIBIT II-1

#### MAJOR BUYER ISSUES—1988

- Rising management expectations
- User demands for increasingly complex solutions
- "Mission-critical" solutions
- Integration—data/applications/technology
- Managing the technology investment

Information systems have become basic functional tools for information users, who are demanding a wider range of applications available in a user-friendly format. The desired capabilities require implementation of increasingly complex system solutions. Further, the proposed solutions must satisfy critical requirements of the client's operation or mission to make specific contributions toward the organization's bottom line.

Today's IS manager sees the need to provide integrated information infrastructures to meet increasing user applications and to support executives and decision support systems.

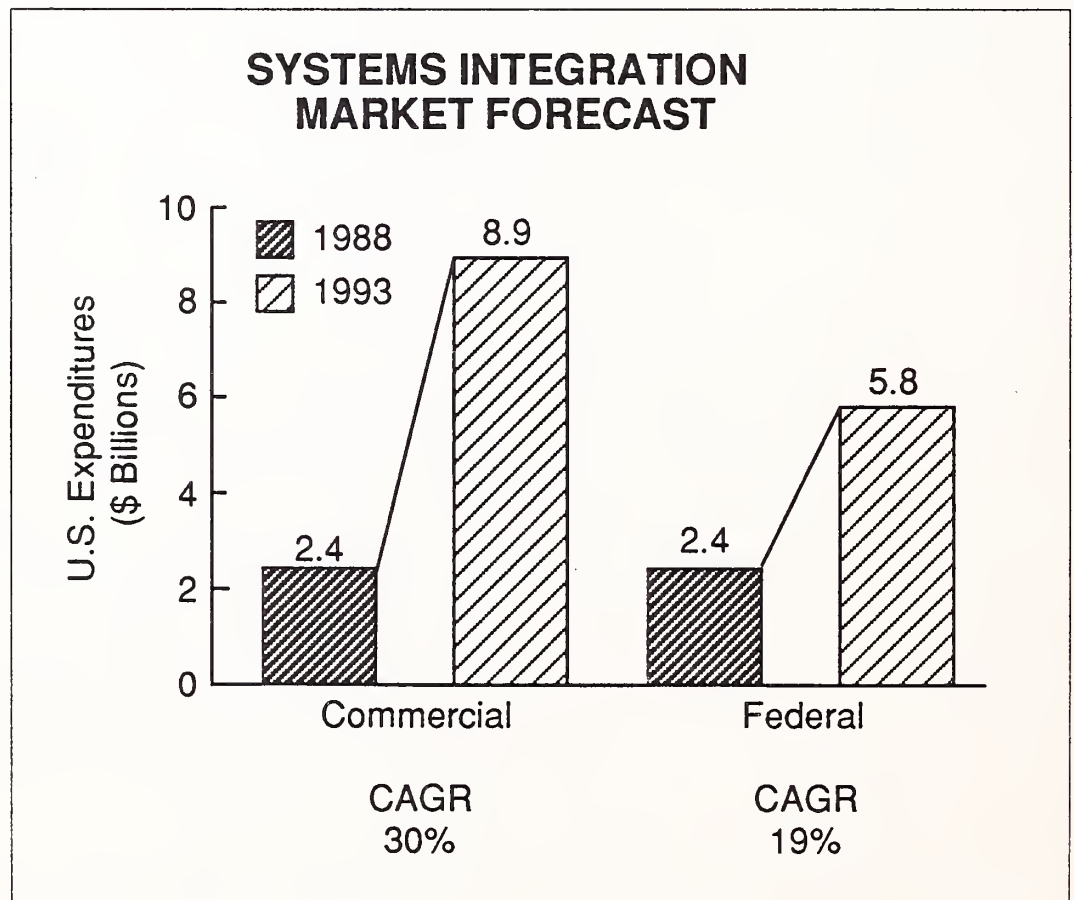
Executive management sees the IS manager in a new role as chief information officer, responsible for all of the technology investment in data processing and communications.

## B

### Systems Integration Market Forecast, 1988-1993

Despite the softening economic environment during the election year, domestic industry spent a record \$457 billion on capital equipment in 1988. The unexpected increase of 10.8 percent over 1987 outlays was the largest since 1954, and indicative of the tenor of businesses being faced with another round of overseas competition. Exhibit II-2 forecasts the systems integration market from 1988 to 1993.

EXHIBIT II-2



Commercial systems integration customers responded with expenditures of \$2.4 billion, despite a softer 1987. The still cautious levels of industry investment in new and expanded information systems is expected to reach \$8.9 billion in 1993, at a CAGR of 30 percent, down from the 38 percent predicted two years ago.

The growth in demand is focused in four vertical industries, and not uniformly spread across those facing increasing competition. Narrowing margins and some reluctance to use more than business intuition are expected to delay the increasing demand for systems integration.

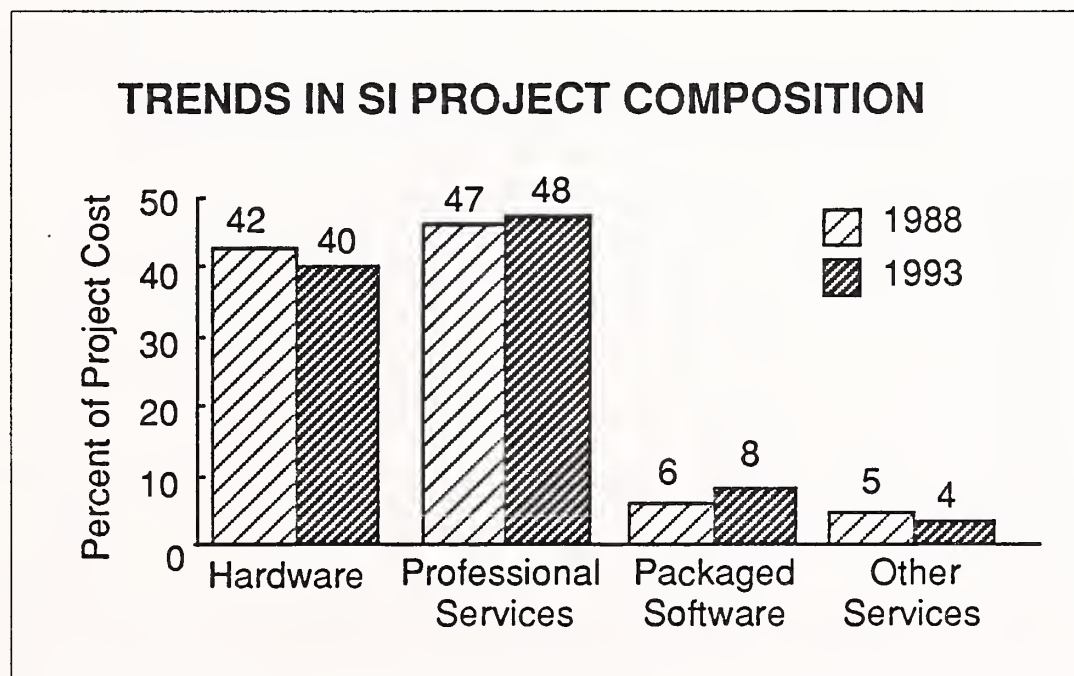
The federal market has improved with an increase in large system authorizations, delayed earlier by the Gramm-Rudman-Hollings Act to constrain the national budget deficit. 1988 expenditures reached \$2.4 billion, and are expected to increase to \$5.7 billion in 1993 at a CAGR of 19 percent, higher than forecast just a year ago.

## C

### Trends in SI Project Composition

The anticipated early growth of the professional services component has continued, but the computer and communications hardware investments in 1988 are greater than originally forecasted. Although somewhat smaller amounts of hardware (40%) will continue to be acquired, users will increasingly buy professional services and custom software to "make it happen" with new technology. Exhibit II-3 illustrates trends in SI project composition.

EXHIBIT II-3





Substantially increased demand is expected for consulting, systems design and integration, software development, training, documentation, and the critical element of project management. Increasing technical complexity, a widening range of operational alternatives, and the demand for risk containment is moving user management steadily toward greater utilization of SI vendor professionals.

The continuing shortages of qualified program managers and the workloads of the current staffs has moved federal agencies to a greater level of SI vendor employment than the commercial sector. Although there is greater resistance to the use of software products in the government, there is mounting custom software maintenance.

## D

### Forecast by Industry Sector

The majority of CSI opportunities will appear in discrete manufacturing, which will exceed banking/finance by 50 percent in 1993. Key among the project applications will be computer-integrated manufacturing, computer-aided design, and computer-aided maintenance management. The industry is being driven by offshore competition to improve production facility flexibility and customer response times. Exhibit II-4 presents forecasts by industry sector.

EXHIBIT II-4

#### FORECAST BY INDUSTRY SECTOR

Sector	\$ Billions		CAGR (Percent)
	1988	1993	
Discrete Manufacturing	0.58	2.3	32
Banking/Finance	0.23	1.5	45
State and Local Government	0.38	1.1	23
Retail Distribution	0.14	0.75	41

The main objectives in discrete manufacturing CSI projects will be to link the factory shop floor with the back office planning and control activities, to tie the network of upstream suppliers and their delivery schedules with the daily manufacturing plan, and to provide a two-way



link from the factory to the field sales force to integrate customer requirements with production.

The second largest CSI market will be banking and finance. While this sector is still recovering from the over-ambitious attempts of software product vendors to integrate banking operations, deregulation insures that companies in this sector cannot stand still. As with manufacturing, integration of upstream and downstream operations into a cohesive, single information system will provide great CSI opportunities.

While the first three industries have remained in the same order of growth potential as in 1986, retail distribution has replaced the insurance industry. CSI projects for distribution will have objectives similar to discrete manufacturing, with the exception of substituting storage and transportation facilities for the factory shop floor, and will include increased automation.

## E

### Vendor Goals and Objectives

The multiyear contract duration of a CSI project and the required close relationship with the client promotes the opportunity to establish or maintain account control for project enhancements or new systems. The multiyear contractual relationship in the federal market provides a legal basis for extended client service (up to sixteen years for some very large installations). Vendor goals and objectives are summarized in Exhibit II-5.

EXHIBIT II-5

#### VENDOR GOALS AND OBJECTIVES

- Long-term account control
- Full-service image and skills
- Market niche development
- Multiindustry market position
- Proprietary technology

The full service image allows the vendor to respond to a wider variety of projects for a longer period, since it could include post implementation operations support (facilities management). Alliance development can be key here, to satisfy the user requirements within a single agreement.

Either unique market niche development or a cross-industry market position is highly desirable to provide a stream of opportunities with minimal expense or competition. A few large vendors, like IBM, Andersen Consulting, and SHL Systemhouse have also established a presence in multiple industries.

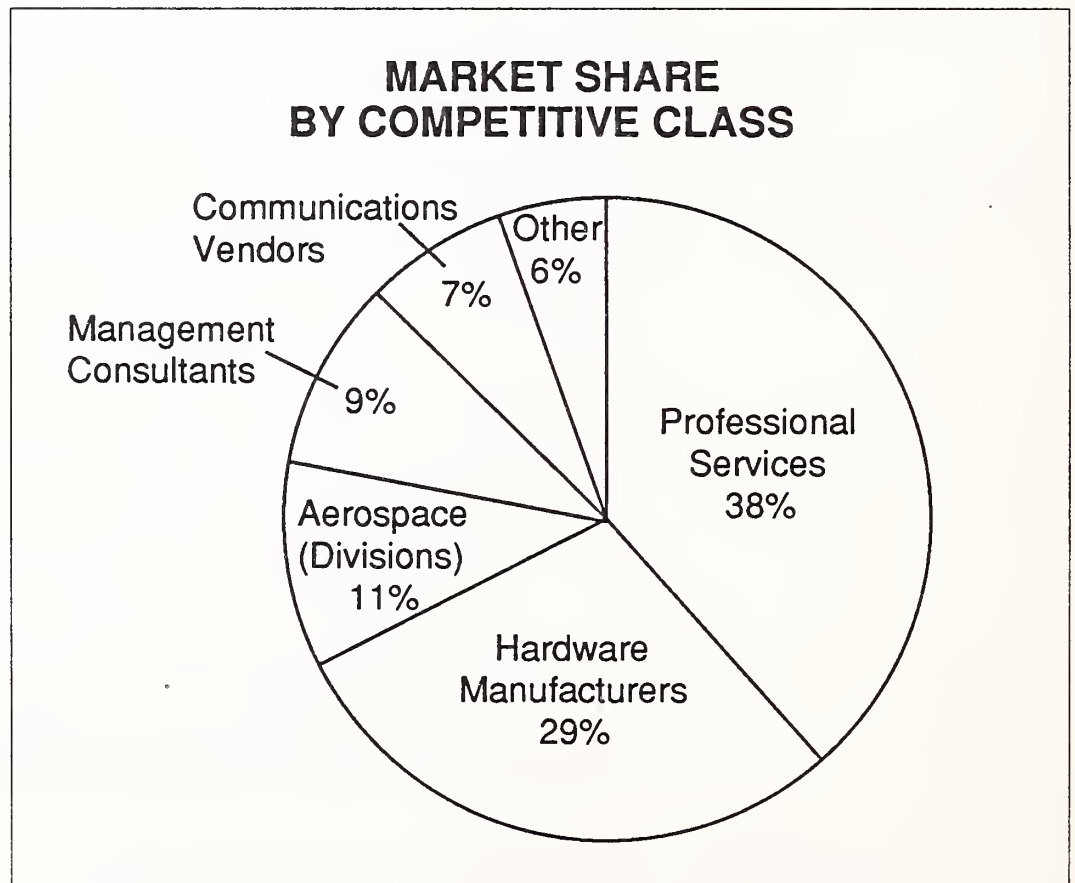
Development of proprietary technology and related products/services can offer increased profit margins, opportunities to sell to other SI vendors, and the prospect of repeat sales.

## F

### Market Share by Competitive Class

In today's market virtually every major information industry vendor claims systems integration experience and skills. However, vendors in the industry come from or are part of a variety of industrial categories experienced in data processing and communications. The principal categories are shown in Exhibit II-6.

EXHIBIT II-6



Professional service firms have moved into a leading position in the last two years in both the federal and commercial sectors, and are expected to maintain this dominance in the future. The increasing complexity of systems designed to meet new user demands, based on better use of existing resources and the introduction of new technology, will emphasize the role of the hardware independent vendors.

Hardware manufacturers continue to sell increasing amounts of "iron" to SI projects, but most have lost the lead as systems integrators to the professional services vendors. They will not accept this market position, and are adding professional service skills to their staffs and to offer complete solutions using a variety of hardware offerings.

The data systems and services divisions of aerospace firms have improved their market share, primarily in the federal marketplace, as they diversified away from defense and the transportation industry. These firms are expected to leverage their extensive systems knowledge into the commercial sector during the next decade, but are having difficulty entering vertical markets that lack synergy with their core businesses.

Management consultants, led by Andersen Consulting, have asserted a leading position separating themselves from the computer-based professional service vendors. Their present emphasis is the commercial sector, where they rank third. They lead the communications vendors in both sectors.

## G

### Vendor Market Share, 1988

IBM is the leading vendor in both sectors of systems integration in what must be considered a commanding lead. This hardware manufacturer's experience in systems extends back more than thirty years, long before the SI acronym appeared in print. IBM has increased its focus on this market with the formation of its Systems Integration Division in 1988, combining commercial and government business for better coordination and critical mass. Vendor market share in 1988 is presented in Exhibit II-7.

EDS, now a subsidiary of General Motors, is the leading professional services SI vendor, second in revenues to IBM in the federal sector, as well as overall. Market strategy is based on familiarity with the vertical market through experience in remote data processing and/or facilities management for similar clients. Strong project management and risk management practices have made EDS an aggressive competitor.

Andersen Consulting has followed a long-term strategy of cross-industry marketing, yet has also developed a CIM demonstration facility to show its many skills in a single vertical industry. The Arthur Andersen subsidiary is the second largest SI vendor in the commercial sector accounting for its strong position overall, despite the absence of hardware sales



## EXHIBIT II-7

**VENDOR MARKET SHARE, 1988**

Vendor	Revenue (\$ Millions)	Percent
IBM	850	18
EDS/GM	505	12
Andersen Consulting	383	8
CSC	345	7
Unisys	335	7

from its revenues, as required by industry practice. The company is not currently a significant player in the federal sector.

CSC made its SI mark in the government sector, both state and federal, employing its extensive experience as a full-service vendor to win contracts. This firm is third in the federal sector and a frequent competitor of EDS/GM. The company acquired Computer Partners and Index Group to enhance its credentials in the commercial sector.

Unisys, which combined the products, services and skills of Burroughs and Sperry (UNIVAC), follows closely behind CSC because it has won a number of commercial projects, in addition to its government SI business.

**H****Recommendations**

SI Vendors need to present the image of a full-service organization to gain the client's confidence. If the in-house mix of skills lacks resources to address a client's needs, the void must be filled by consultants or alliances with a demonstrated commitment to the project. Exhibit II-8 provides a summary of recommendations.

Proprietary technologies and methodologies with a demonstrable relation to systems integration provides the vendor with a unique marketing advantage. The technology/methodology can offer improved margins and offer insurance for successful completion of the project.

## EXHIBIT II-8

**RECOMMENDATIONS**

- Present full-service image
- Leverage proprietary technology
- Establish strategic partnerships (alliances)
- Manage risk containment
- Maintain project management skills

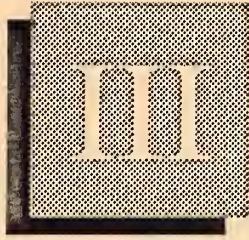
The prospective vendor must understand the business processes of the client to be able to recommend changes in the workplace, which implies market specialization. Selection of market relevant partners or alliances can be crucial to the success of the SI vendor in the target markets or industries.

Systems integration is a big-stakes game, with great potential for failure for a variety of reasons. The client is aware of the gamble and will give higher marks to the vendor who can demonstrate a good track record of risk-containment management methods.

Success of the SI project is highly dependent on the skill and authority level of the project manager, who must also manage the user to assure acceptance of the final delivery without surprises.



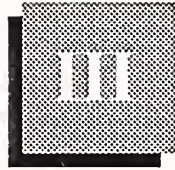




# Market Analysis and Forecast







# Market Analysis and Forecast

Systems integration in the commercial sector is relatively new, despite more than thirty years of its application in the federal government. While there are differences between the two sectors, principally in the manner in which opportunities arise and are bid, the SI components offer many similarities. A number of vendors in the market now have contracts in both sectors.

In this section, the market will be defined to establish the framework; the components will be sized and forecasted; the key driving and hindering forces will be identified; and the competitive environment will be described. The first step is to define systems integration and the market structure.

## A

### Market Structure

INPUT's definition of systems integration has been refined during the course of the Systems Integration Program (SIP), to clarify the boundaries of the reportable market, both commercial and federal.

#### 1. General Market Characteristics

##### a. Definition

Systems integration is a business offering that provides a complete solution to a complex information system, networking, or automation requirement through the custom selection and implementation of a variety of products and services.

A system integrator is a business organization responsible for overall management of a systems integration contract and is the single point of contact and responsibility to the buyer for system function, performance, schedule, cost, and final delivery.



Critical to the approach from both the client's and vendor's perspectives is the sharing or total transfer of responsibility (and risk) for the successful development of the system from the client organization to the vendor(s). In exchange for assuming the risks of failure to deliver the desired solution on time and within budget, the integrator receives not only project management fees from the client but also markups from subcontractors and the "inside track" in providing any of the products and services that comprise the total solution.

## **b. Products and Services**

INPUT divides systems integration into four subdelivery modes:

- Professional services
- Custom software
- Packaged software
- Equipment

This approach allows a more comprehensive comparison of projects in and between different commercial sectors, as well as within the federal government sector. At times, professional services may be subdivided into software development, program/project management, consulting/design/integration, education/training and documentation, and systems operation (facilities management).

Exhibit III-1 enumerates the component products and services that may be a part of a systems integration project and for which the vendor can expect to receive revenue. Since each project is unique in terms of specific requirements, not all of these components are applicable to every SI project. Further, the unique requirements dictate the proportion of the total project expenditures to be made for each component involved.

In the current SI definition, INPUT includes within the project revenue all those post-implementation activities that are included in the original contract. These would include operations and maintenance (O&M) or systems operation (SO). O&M can include equipment/network maintenance, software maintenance, extended education and training of client employees, and network management. SO, previously called professional services facilities management, provides vendor management and operation of customer owned information processing and/or network facilities.

Several exclusions apply to the list of SI products and services shown in Exhibit III-1:

- "Embedded" systems that are part of a construction project, exclusively end-connected to machinery or tools or industry-specific transportation facilities

## EXHIBIT III-1

**PRODUCTS/SERVICES IN  
SYSTEMS INTEGRATION PROJECTS**

- Hardware
  - Information systems
  - Communications
- Software products
  - Systems software
  - Applications software
- Professional services
  - Consulting
    - Feasibility and tradeoff studies
    - Selection of hardware, network, and software
  - Project management
  - Design/integration
    - Systems design
    - Installation of hardware, network, and software
    - Demonstration and testing
  - Software development
    - Modification of software packages
    - Modification of existing software
    - Custom development of software
  - Education/training and documentation
  - Operation and maintenance/systems operation
- Other miscellaneous products/services
  - Data processing supplies
  - Processing/network services
  - Data/voice communication services

- Robots and dedicated automation equipment that is separately programmed and operated outside of the plant information system(s) data stream.
- Turnkey systems that are prepackaged to satisfy a specific application or applications and generally designed to function in a standalone mode.

## 2. Commercial versus Federal Systems Integration

The federal government has relied on systems integrators to develop, upgrade, or replace automatic data processing systems for over thirty years. Commercial systems integration, with some of its roots in federal SI, has both striking similarities and differences with government contracting (see Exhibit III-2).

The commercial sector customer is less likely to have the legal or technical background required for many projects, and when this knowledge is available, it is only available in pieces from numerous personnel within the client organization. In the federal government, on the other hand, the thrust has been the establishment of project offices that include both technical and legal representatives that speak for the sponsoring agency. Fewer interfaces are required.

A key difference of vendor characteristics is the formality with which vendor reputation is evaluated as a part of the bid selection procedures in the federal marketplace. In most cases, a vendor's estimated versus actual performance on cost and schedule measures is recorded (the Defense Contract Audit Agency does this for Defense, but makes the evaluations available to all agencies). Agencies use this historic information to specifically and formally weigh the vendor's past performance.

In the commercial world, a federal track record of successful implementations may be desirable and leverageable. Customer business knowledge is a key requirement because the commercial customer looks to the vendor to offer a business solution. State and federal agencies are more specific about the desired solution, at least functionally, and less dependent on vendor business consulting/recommendations.

The business conditions associated with the two markets are widely divergent, with some definite advantages to the government market. The federal agencies advertise in the *Commerce Business Daily* (Department of Commerce publication) about impending solicitations, and describe key programs in publicly available documentation and field sales can help to qualify the opportunity. Commercially, the vendor is nearly totally dependent on the sales force for leads.



## EXHIBIT III-2

### COMMERCIAL VERSUS FEDERAL SYSTEMS INTEGRATION CHARACTERISTICS

Characteristic	Commercial	Federal
<b>Customers</b>  Requirements knowledge Technical knowledge Interface	Low Variable Multiple	High High Single
<b>Vendors</b>  Vertical expertise Customer base Business knowledge Reputation	Preferred Leverageable Required Media-based	Mandatory Reference Optional Historic
<b>Business Conditions</b>  Lead generation Competitive bids Bid complexity Expenditure commitment Risk exposure Contract type Price restrictions Bonuses Penalties Profit potential	Field sales Optional Variable Deferrable High Fixed-price Competitive Unlikely Unlikely High	CBD/budgets Required High "Guaranteed" Contained Combination Ceilings Awd./incent. Exception Limited

The requirement for competitive bids for expenditures over \$100,000 in the federal sector has no counterpart in the commercial world. While competition is a vehicle for the client to achieve the best solution at the best price, other factors (vendor reputation, comfort level with the vendor, etc.) do come into play. Further, the requirements for competition are such that agencies may not generally specify name brand products in the request for proposal (RFP). The federal process is more open and public, fostering a great deal of competition in which discounting or fixed-price bidding is frequent.

Competitive bidding in the federal sector makes for complexity that involves more time, effort, and money on the part of the vendors, with no assurance of award. Bidding expenses are recoverable, but stringently controlled.

The trade-off is that once the process starts in the federal sector, the expenditures are virtually guaranteed, or termination costs are paid to close the project down. In the commercial area, expenditure commitments may be deferred or withdrawn at the client's choosing with no recourse for the bidding vendors.

The risks to the contractor appear to be much greater in the commercial marketplace. The contracting rules in the federal arena lead to compliance with the "letter" of the specifications and some measure of risk-sharing with the client agency. The absence of these rules in the commercial marketplace creates an environment where the specifications are more at issue and, consequently, more subject to interpretation (and misinterpretation), creating the prospect of contract performance suits.

Unless the contract is fixed price, federal regulations may specify price ceilings. Fair pricing regulations specify that profit can be no more than 15% and permit agencies to audit vendor records to verify these conditions. There are no counterpart rules in the commercial sector, where competition and demand determine the acceptable price range.

Vendor capabilities in the commercial sector are usually based on written proof, previous success testimony, or live-systems demonstrations simulating a critical function of the desired system. In the federal marketplace these capabilities are frequently required to be "proven" by scores under the "Weighted Guidelines," actual performance against standards (benchmarks) established for the project's system, or "compute-offs" against competitors.

Pricing strategies differ in that commercial jobs are frequently fixed-price without bonuses but with penalties. Government contracts are typically fixed-price and cost-plus for medium-sized jobs. Further, it is not unusual for the government to reward a contractor for a low-priced bid (award fee) or provide incentives for beating cost or schedule estimates.

In-depth reviews of component performance are required by contracts of federal agencies as a means of verifying/validating a contractor's work. This practice will be found less frequent in the commercial arena.

The commercial/federal SI market distinctions revolve around the formality and regulatory backbone of the process. Some of these more formal practices of the federal and state government market are being adopted by the commercial market where exposure to new regulations



make the benefits obvious. Commercial clients will eventually adopt those practices that protect them.

### 3. Industry Market Sectors

The design and application of information resources is evolving along several avenues, each attracting vendors with particular configurations of skills, resources, and experience. At least up to the present, most vendors have focused on one or more vertical industries, where a successful implementation can be leveraged to other clients in the same industry or enhancements to the original contract. More recently, however, specialists in cross-industry (non-industry specific) technologies have teamed with industry-specific vendors to improve prospects of awards. Some vendors with good visibility have undertaken cross-industry projects alone. The sectors that are analyzed, sized, and forecasted in this report are listed in Exhibit III-3.

EXHIBIT III-3

INDUSTRY MARKET SECTORS	
Industry-Specific Sectors	Cross-Industry Sectors
Discrete Manufacturing	Accounting
Process Manufacturing	Education and Training
Transportation	Engineering and Scientific
Utilities	Human Resources
Telecommunications	Office Systems
Wholesale Distribution	Planning and Analysis
Retail Distribution	Automation
Banking and Finance	
Insurance	
Medical	
Services	
State and Local Government	
"Other" (Education, Agriculture)	
Federal Government	

### **a. Vertical Markets**

The sectors identified are the same as the listing employed by INPUT for the Market Analysis Program, and with which the SI estimates must be correlated. The SIC codes associated with each sector are listed in Appendix B of this report.

For this version of the CSI forecast and trends, the distribution sector has been divided into retail and wholesale because they are growing at different rates. Changes from the 1986 forecast levels are discussed in Section IV.

The "other" sector usually combines those industries with smaller than average commercial industry size or growth potential. The Section IV analysis of vertical markets combines the education and agriculture sectors, and the services sector includes a number of independent professional and technical service components.

### **b. Cross-Industry Sectors**

Cross-industry sectors in the SI market were analyzed for this report on the basis of projects included in the data base assembled for the *Systems Integration Project Reports* (SIPR). The relative size of the market sample, including vendors identified with those projects, is reported and discussed in Section V.

All of the sectors listed in Exhibit III-3 were represented in the data base, but to varying levels, which would be expected. The project data base is not a true random sampling, and some of the sectors tended to be integrated by in-house staffs of the clients. The leading sectors, such as office systems, engineering & science systems and automation systems, concern client information processing functions that are found in most of the vertical industry markets. At this time, there is less pressure to integrate human resources, education/training, planning & analysis, image processing, and accounting systems with the rest of the infrastructure supporting the line of business.

In an effort to provide better insight to vendor positioning and project opportunities in the commercial SI market, two additional analysis were made of the SIPR Data Base similar to cross-industry, and are discussed in detail in Section V.

### **c. Project Focus Classification**

The first of the special analyses is based on the nature and focus of the projects.

This screening method permits collection of projects into three, now four, subgroups, using key relationships, technology requirements, type of vendor attracted to the individual focus classification, and strategies employed to implement the focus of the project. The focus classification levels used in this analysis consist of:

- Applications-focused projects deal with the processing of information to accomplish a business function. The critical technologies are CASE tools, applications shells, and software design.
- Data-focused projects deal principally with the infrastructure of equipment, system software, data analysis and design tools, and data base software.
- Technology-focused projects emphasize delivery capability, and operations improvements, via two channels:
  - Networks tie the disparate elements of the business together, to enhance and expedite the transfer of information and control decisions.
  - Technology insertion includes new automation tools, automated processes and production, data collection and dissemination, and computing hardware.

#### **d. Infrastructure Integration**

The second analytic grouping is based on a particular type of project that is aimed at integrating and interconnecting specific infrastructures, to meet demands for support of increased user applications, sharing companywide information, and decision support requirements. The four categories selected for this analysis are:

- Network infrastructure integration addresses the full spectrum of communications, frequently under the control of a computer-aided network management system.
- Data base infrastructure integration deals with the entire data/information collection, process/filing, and dissemination process, to support executives and end users.
- Office system infrastructure integration concerns the interconnection of office automation devices with central files, executive workstations, and special peripherals.
- Factory infrastructure integration ties together resource and materials planning, production control, transportation, and the front office for increased efficiencies.



#### 4. Vendor Classification

Assessing the range and depth of the leading vendors also enables evaluation by other vendors of the possible degree of competition and/or teaming to address a particular class of opportunities. Several methods have emerged during the past SI year.

Market share by annual revenues permits sizing of the leaders. In the present analysis, this was further subdivided into commercial and federal markets, because there are substantial differences among all but a few leaders.

Market share by class of competition employs six distinct classes of the primary line of business of the SI vendors, and is further subdivided by commercial versus federal markets. The classes used in this analysis are:

- Hardware manufacturers
- Communications vendors
- Professional services
- Big Eight (and management consultants)
- Aerospace
- Other (engineering, construction, etc.)

Preliminary analysis was also conducted along the lines of key services and/or products, similar to the production/services listing shown in Exhibit III-1.

Another avenue of classification discussed at the summer workshop was identification of significant secondary market vendors and their specialties. This analysis was not continued beyond that described at the second seminar, and is based on information acquired for the annual *Information Service Industry Specific and Cross-Industry Markets* report (INPUT's Market Analysis Program).

## B

### Market Forecast

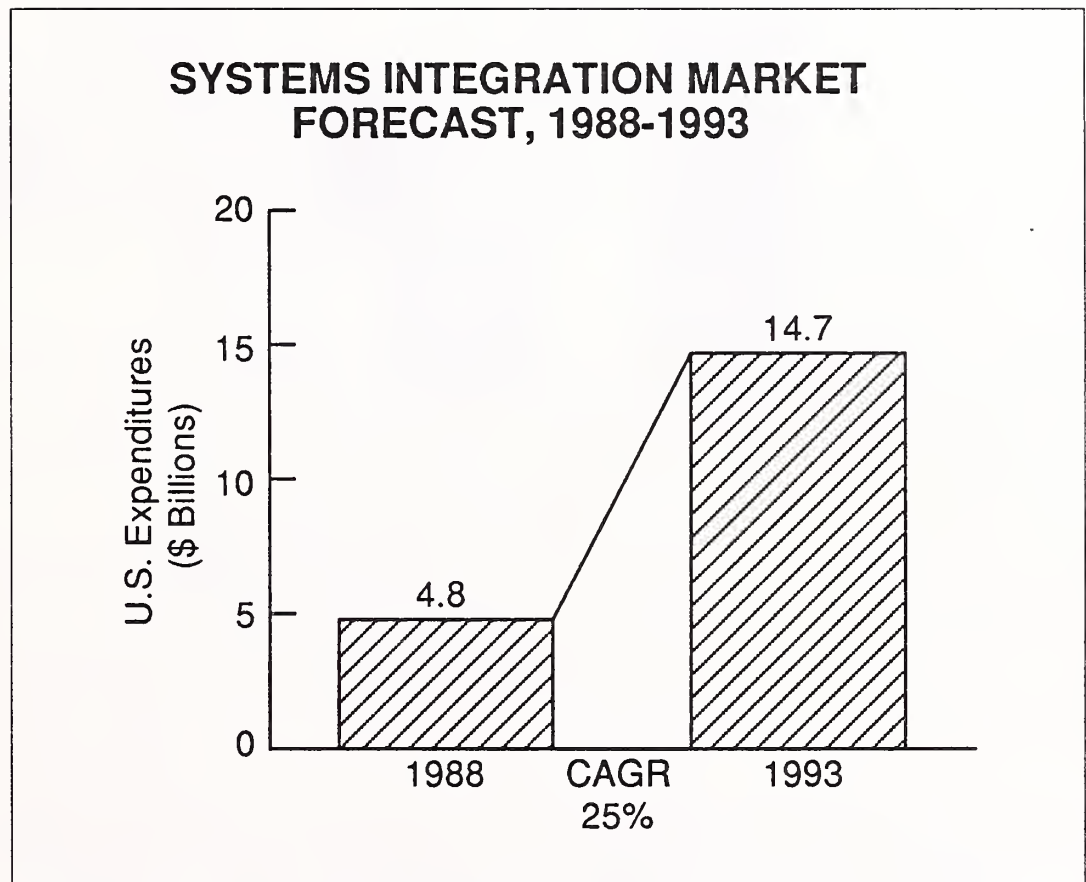
The systems integration market is driven by several factors that will be discussed in the next subsection (C). The prime mover, however, is the availability and commitment of funds with which to implement the information system solutions.

In 1988, U.S. industry is estimated to have invested \$427 billion in capital equipment, an unexpected increase of 10.8 percent over 1987 and the largest increase since 1954. Despite the concerns about slow growth of the GNP, the industries queried by the U.S. Department of Commerce indicated their intention of spending \$465 billion in 1989, an increase of 9%. These numbers are significant because it has been estimated that about three percent of the capital investment expenditures goes toward information systems additions, improvements, and replacements that are likely candidates for systems integration projects.

Similarly, the U.S. Federal Government continues to invest in data processing and communications products and services, despite concerns about budget deficits and rising costs. The federal information technology budget represents about 1.6 percent of the total budget, and continues to grow at nearly twice the rate of the national budget.

On the basis of these changes in investment rates, INPUT forecasted expenditures of \$4.8 billion in 1988 for the combined commercial and federal systems integration market. Growing at compound annual rate of 25 percent, expenditures will reach \$14.7 billion in 1993, as illustrated in Exhibit III-4.

EXHIBIT III-4

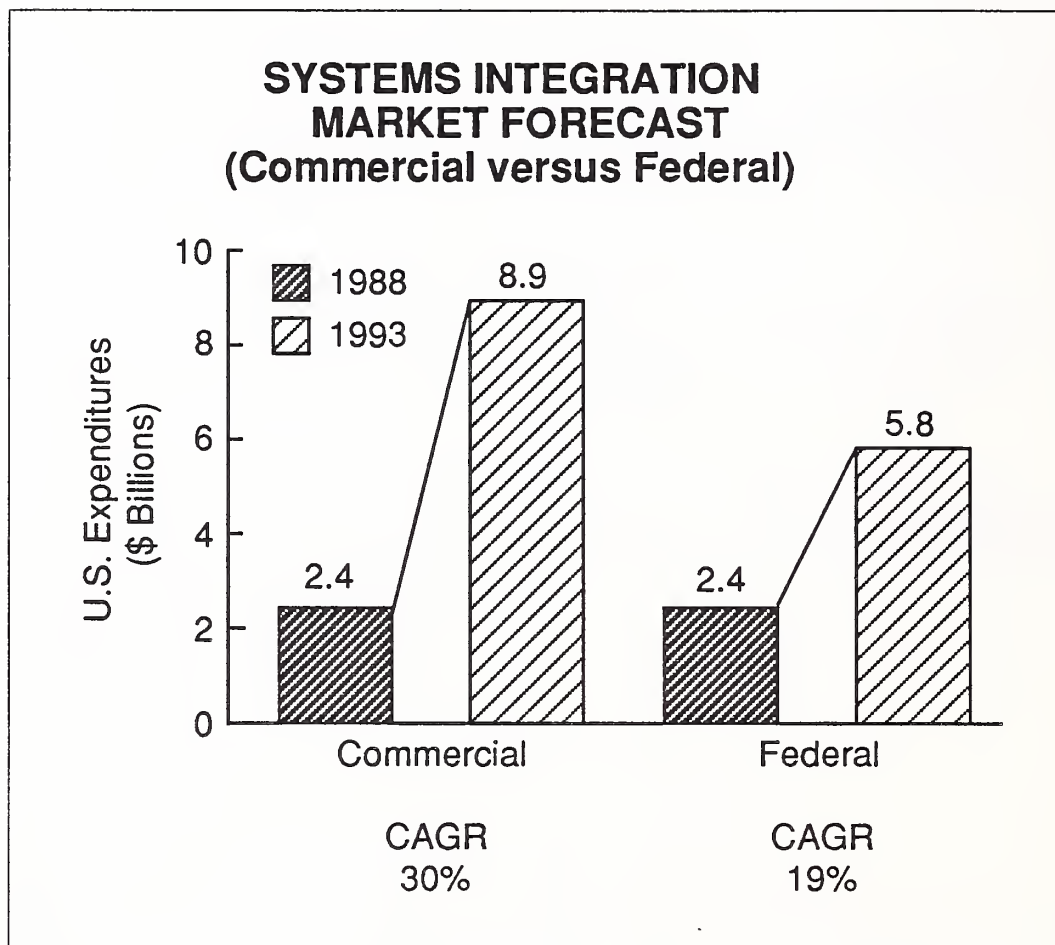


### 1. Commercial versus Federal SI Markets

A number of changes have taken place in both the commercial and federal markets since 1987. Although the expenditures in the commercial market in 1988 reached, and may have slightly exceeded, INPUT's forecasts made in 1986 and 1987, the out year prospects suggest a slower, less ambitious CAGR of 30 percent, and not the earlier 38 percent. The strong industry markets of manufacturing, banking/finance, and state and local government stand out from the remainder of the industry. Annual commercial SI expenditures are expected to reach \$8.9 billion in 1993 as indicated in Exhibit III-5, not the \$11.4 billion forecasted earlier.



EXHIBIT III-5

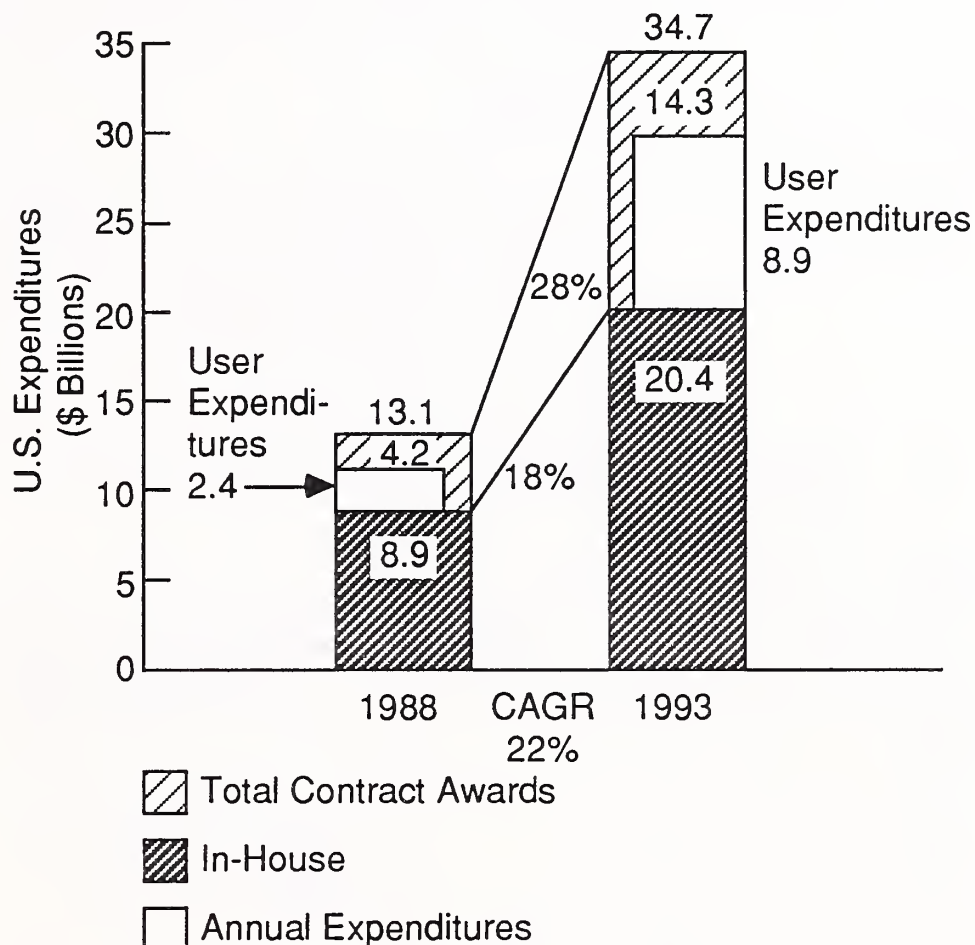


Two significant changes have occurred in the federal government market that influence both the 1988 expenditure base and the out year growth prospects. Several major SI projects had been delayed by deficit budget controls under the Gramm-Rudman Hollings Act in 1986. These were awarded early in 1988, increasing agency outlays by more than \$700 million, to reach \$2.4 billion. Out-year prospects beyond 1993 were also increased by the award of the Sector Suite project of the FAA's Advanced Automation Project to IBM/CSC/Raytheon for \$3.55 billion. Action is also expected on a major overhaul of the income tax system of the IRS that could add another \$900 million in expenditures in this period. A rate of \$5.8 billion in 1993 is considered quite feasible by many federal budget experts, despite continuing budget pressures.

INPUT's earlier report on *Commercial Systems Integration Markets, 1986-1991* (circa 1986) also estimated the value of contracts awarded in 1986, and the value of major in-house projects begun in the same year. These were projected to increase through 1991. Exhibit III-6 indicates INPUT's current estimates of these project values. The forecasts is based on U.S. Department of Commerce capital investment forecast, samples in the SI Project Data Base, and revision of the forecast data base used in 1986.

## EXHIBIT III-6

### COMMERCIAL SYSTEMS INTEGRATION PROJECT VALUES AND EXPENDITURES, 1988-1993



INPUT's forecast assumes that only the largest companies in each vertical industry will use CSI vendors over the forecast period, and that the number of projects will increase with time.

At an estimated average project value of \$4.8 million in 1988, about \$13.1 billion in projects was started in 1988, slightly more than three percent of the \$427 billion reported for capital investment for the year. By 1993, growing at a CAGR of 5%, the average project value will be \$6.2 million; with total projects value reaching \$34.7 billion, at a CAGR of 22 percent.

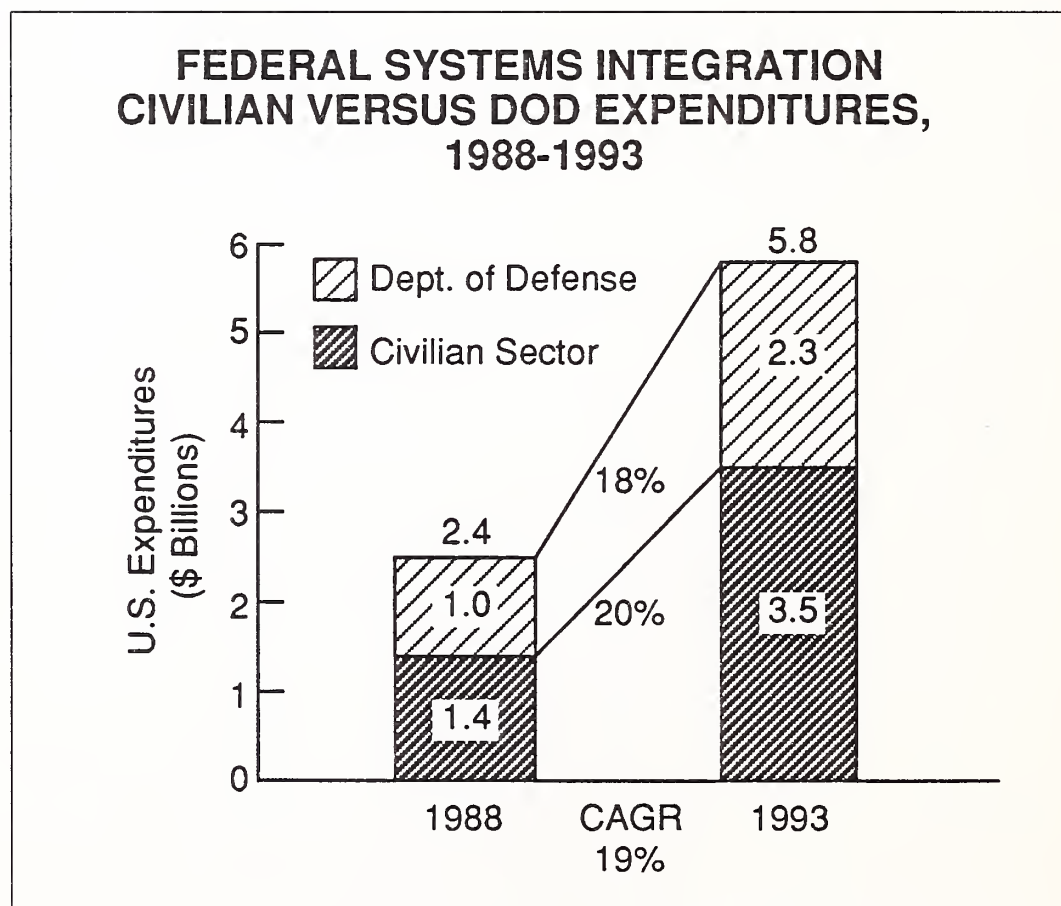
In 1988, an estimated 32% of total project values, \$4.2 billion, was contracted out to SI vendors. By 1993, about 40% of the total projects value could be contracted, for about \$14.3 billion, with expenditures in that year of \$8.9 billion.

The expectations for major in-house and contracted projects in 1988 appear to have been slightly exceeded, as will be noted in the leading contractor revenues reported in Sub-section III-D.

The 1988 estimates for 1993 are about \$2.5 billion greater for in-house projects than earlier forecasted because of expectations of increased funding in the early 1990s, in anticipation of the trade impact of the integration of the European Common Market and increased Pacific Rim penetration.

In the federal SI forecast published by INPUT in 1986 there were comments that the defense budget growth rate would begin to decline. Ten-year defense forecasts issued late in the Carter Administration noted the declining rate, except for research and development. Earlier in the 1980s, defense was authorized to "catch-up" in information resource spending to overcome the lean years following termination of the Vietnam War. It has been evident since 1987, however, that the pendulum would begin to swing back toward the civilian agencies, as noted in Exhibit III-7.

EXHIBIT III-7



Expenditures in 1988 for civilian agencies are already 40 percent higher than defense spending, and is expected to reach \$3.5 billion in 1993. In addition to very large projects for the FAA and IRS, work on the Dicen-



nial Census, upgrading the Social Security System, new systems and replacements for NASA, and substantial system replacements for the Justice and Treasury are expected to sustain the 20% CAGR. Office systems, graphics systems, CALS, and on-demand publishing systems are included in the anticipated defense program expenditures, which will be sustained despite cuts in weapons and platforms procurement outlays.

At this point, it is interesting to compare the relative current and forecasted expenditures of the U.S. with those of Western Europe reported in a recent INPUT publication. Exhibit III-8 is republished here from the INPUT-Europe report. Although the base expenditures are quite different, the growth rates are quite close, leading to about the same proportions in 1993. The lower level of SI expenditures in Western Europe are reflective of later acceptance of SI in those countries.

EXHIBIT III-8

### SYSTEMS INTEGRATION— WESTERN EUROPE/U.S. COMPARISON

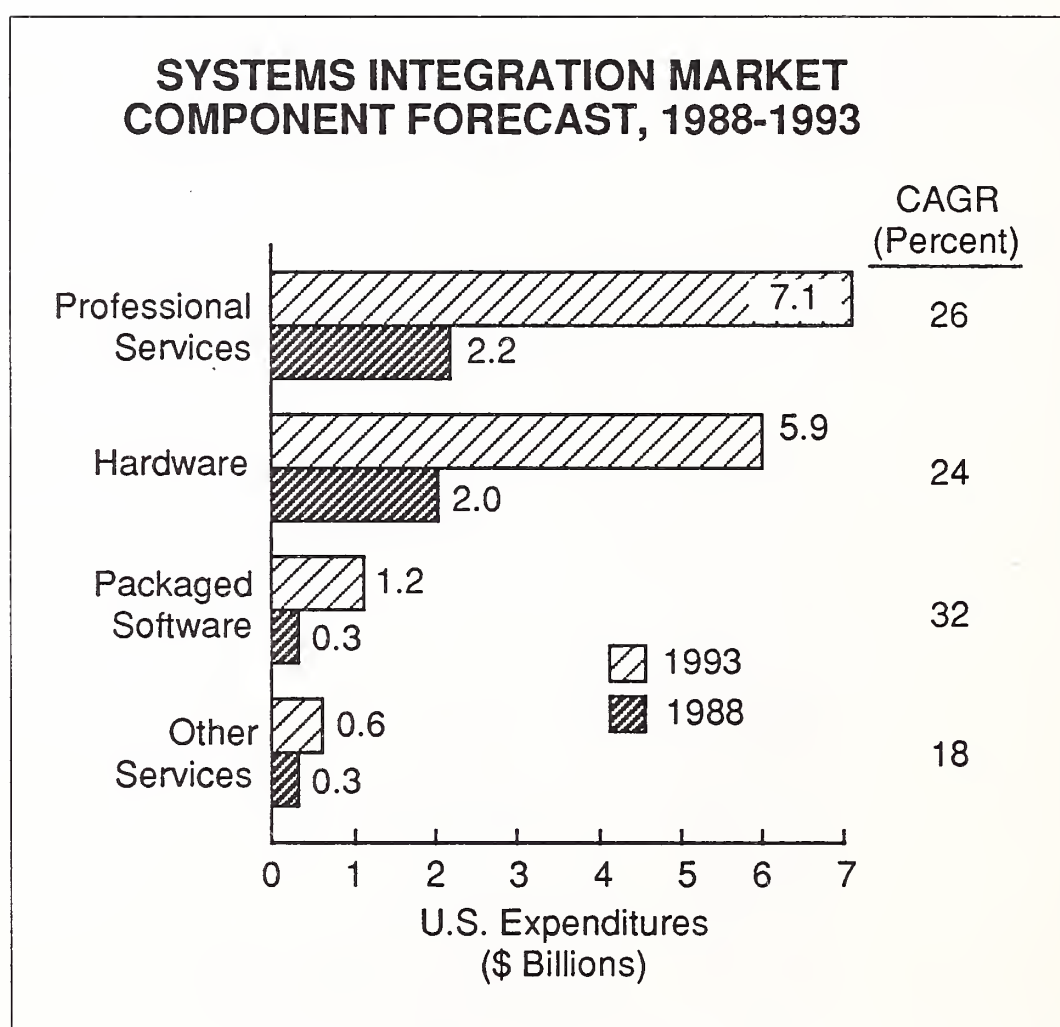
Market	User Expenditures		
	1988 (\$ Billions)	1993 (\$ Billions)	CAGR (Percent)
Commercial			
Western Europe	1.1	4.1	30
U.S.	2.4	8.9	30
Government			
Western Europe	0.5	1.0	15
U.S.	2.4	5.8	19
Total			
Western Europe	1.6	5.1	26
U.S.	4.8	14.7	25

In the comparison of the vertical industry expenditures in the following pages fewer industries have substantial IS investments and tend to hold onto the equipment far longer than U.S. companies. The INPUT Western Europe report makes note of the lower investment levels in data processing in both government and commerce vertical industries.

## 2. SI Component Forecast

The forecast expenditures by component group are illustrated in Exhibit III-9 and trends between components are illustrated in Exhibit III-10. Also included are a comparison with Western European trends, and a distribution of components in the commercial and federal sectors of the SI Project Data Base, covered in greater detail in Section III-D, later.

EXHIBIT III-9



In general, the hardware and professional services components dominate, with professional services leading in 1988 and increasing that lead in 1993. In the professional services component, software development appears to be the primary service required. There also appears to be a moderate rise in packaged software, as that industry addresses the variety of problems in the business world that have been custom developed at



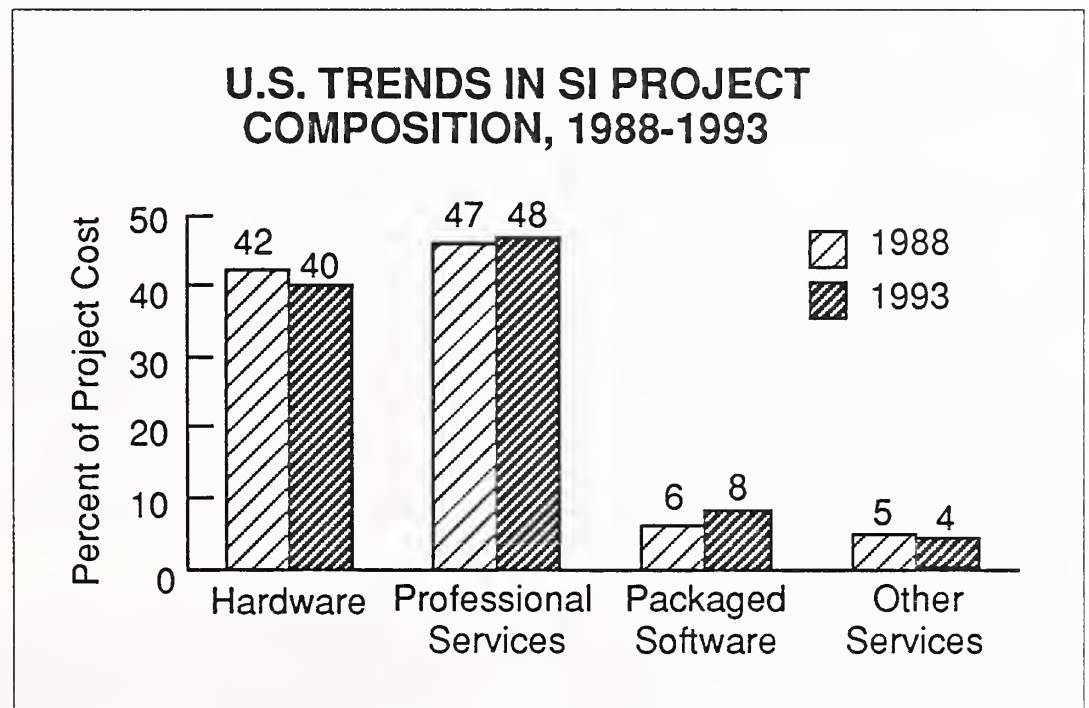
considerable expense. The additional elements of each component, listed earlier in Exhibit III-1, will be briefly discussed below.

#### a. Hardware

Information systems and communications hardware, currently the second largest component of SI expenditures, is expected to decline from 42 percent in 1988 to 40 percent by 1993, (Exhibit III-10). The key reason for the higher level of expenditures in 1988 can be attributed to the replacement of obsolete equipment in the IS and operations departments particularly in the federal market. Some projects may require special-purpose computer/communications-related equipment (vector or array processors, RISC machines, or large data base machines), but this should not have a material impact on the overall allocation of "run-of-the-mill iron." The leading industries in hardware expenditures are discrete manufacturing, state and local government, banking/finance, and utilities.

This "special-purpose" equipment (not custom turnkey systems which are specifically excluded from the definition of SI) may involve "exotic" hardware in some cases but will more likely involve "back-end" data base processors, manufacturing systems, and computer-assisted subsystems for design, microforms, instruction, etc. As discussed above, CSI projects, in the early years at least, will be rather conservative in nature. It is likely that "leading-edge" technology will be avoided, whenever off-the-shelf products can be used.

EXHIBIT III-10



New communications demands, including extensive networks, are expected to remain high through 1991, before abating. Part of the demand relates to networking PCs and workstations to mainframes, as part of business function integration. But an equally important development is the transition to optical fiber and the addition of computer-based network monitoring and management systems. Network infrastructure projects are the largest number of SI projects on the 1987-1988 project list. The leading industries in communication hardware expenditures are banking/finance, discrete manufacturing, and state and local government, in that order.

New applications are emerging as well. Electronic data interchange, (EDI), electronic mail, teleconferencing, telemetry applications (remote diagnostics and meter reading), new consumer-oriented applications in POS, and credit card authorizations are at the top of the list of these applications. They require adaptive technologies that combine the utility of point-to-point communication with the specific communication requirements of the application.

#### **b. Professional Services**

The key ingredient of SI projects is professional services, the "value-added" component that adapts hardware and software to the task assigned. Forecasted as the largest component earlier, these services are still larger than hardware in 1988, and expected to remain the largest cost item by 1993, as indicated in Exhibit III-10.

In the vertical markets, expenditure size is more a function of the overall level of CSI activity in the industry. With only a few exceptions, discrete manufacturing firms should account for the largest portion of professional services expenditures. Other industries with large professional services expenditures include, in ranking order, state and local government, banking/finance, utilities, insurance, and retail distribution.

Consulting services are frequently the precursor of most systems integration projects. Overall planning assistance, feasibility studies, and cost/effectiveness tradeoff studies guide the client to plan for the desired solution. Consulting services can also support sales through in-depth knowledge acquired during the project. Some clients separate consulting from the project, others do not, and some will use consultants to aid them during the project.

Fees are paid to the integrator for planning, scheduling, and controlling the materials and human resources required for the execution of the project management (PM). PM involves the coordination of complex activities to meet time, cost, resource allocation, and performance targets. PM also involves keeping the client informed of the status and progress of the project to avoid surprises and misunderstandings. The

fees also compensate the SI contractor for assuming the risks involved in guaranteeing the effectiveness of the solution. Again, discrete manufacturing leads in PM expenditures, followed by state and local government, banking/finance, and insurance. The last two industries also spend the largest percentage of their projects on professional services.

Another responsibility of the integrator or one of his subcontractors is the actual technical integration of the components. Design/integration services include systems design, integration of computing components, installation, and client acceptance of the data processing and communications systems. As noted earlier, discrete manufacturing is the leading industry in expenditures for this subcomponent, representing more than twice the level of state and local government and banking/finance.

The development of new custom software, the conversion of existing software, or the modification of commercial software packages are key professional services. While this is essentially programming and analysis, it does, occasionally, include independent verification and validation of the new system and software maintenance of that system for a specified period of time. The level of these services varies between industries but the leaders now appear to be discrete manufacturing and state and local government. Banking/finance and utilities are next but only about half the level of state and local government.

Education and training of the client staff on operation of the system as well as full documentation of the systems' operation and maintenance are also critical to the success of the project. Overall expenditures in this category are low, however, because hardware vendors provide many of these services on a customer service basis that is built into the component prices.

Some major projects include a requirement that a vendor operate and maintain the developed system for a specified period of time. This is vendor-staffed on-site support of the system. Under some contracts, the maintenance is under warranty for a defined period, while under others operation and maintenance is a specifically negotiated arrangement that marks the transitions of the system from the vendor(s) who built it to the clients who use it.

### **c. Software Products**

Packaged software does not represent a major expenditure in most CSI projects. While IS managers have been demonstrating a propensity to buy packages rather than pay for unique, custom development of software, the fact is that CSI projects by their nature preclude extensive use of these packages. As indicated in Exhibit III-9, both applications and systems software package expenditures will grow at an CAGR of 32 percent and by 1993, as seen in Exhibit III-10, the annual expenditure will amount to



only 8% of the total SI dollars. The leading industries in software product expenditures are, as expected, discrete manufacturing, state and local government, and banking/finance, in that order. Education and medical industries will spend the largest portion of the project's cost on packaged software.

Projects focus on applications rather than the computer environment in which the applications will run. Accordingly, applications software is expected to outpace systems software throughout the forecast period. SI projects are often focused on core business areas (financial planning, accounting, personnel, production, inventory control) and should be targets for cross-industry applications software in these areas. INPUT believes, however, that clients will continue to reject packaged applications because they are not able to meet many of their unique needs.

The systems software to be acquired is expected to be a basic product that provides control and management of the computer facility. Systems software is the key to how processing power and data will be distributed over computer/communications.

The integration of voice, data, and image information bases also holds promise for additional systems software expenditures. The leading industries in software product expenditures are, as expected, discrete manufacturing, state and local government, and banking/finance, in that order. Education and medical industries will spend the largest portion of the project's cost on packaged software.

#### **d. Other Expenditures**

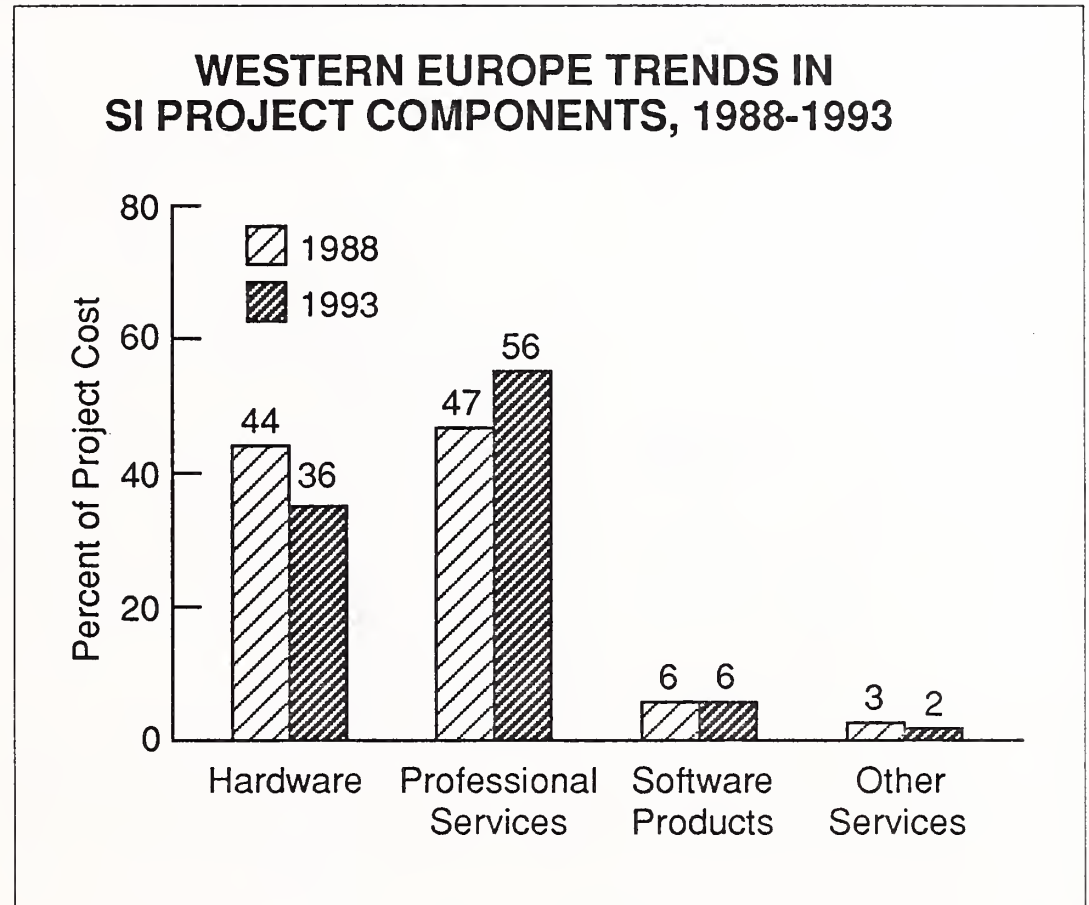
Most projects include other product and service expenditures that are not easily classified elsewhere. This category includes miscellaneous items such as engineering services, automation equipment, computer supplies, business support services and supplies, and other items required to provide a smooth development effort. Processing and network services and communications services that may be required during the course of development are also included in this category. Other than the federal government, the leading expenditures will come from discrete manufacturing, state and local government, and utilities.

#### **e. Comparison with Western Europe**

The Western Europe SI report notes some differences in the relative proportions of components in 1988 and the transition by 1993, as noted in Exhibit III-11, and as compared to Exhibit III-10. Hardware is not the leading component, just as it is in the U.S. market. Furthermore, the shift to an increasing professional services content is expected to be more pronounced by 1993, with 56 percent of project expenditures, as compared to 48 percent in the U.S. at that time. Note also that packaged software

and other services are expected to be a smaller percentage of project expenditures over the entire forecast period.

EXHIBIT III-11



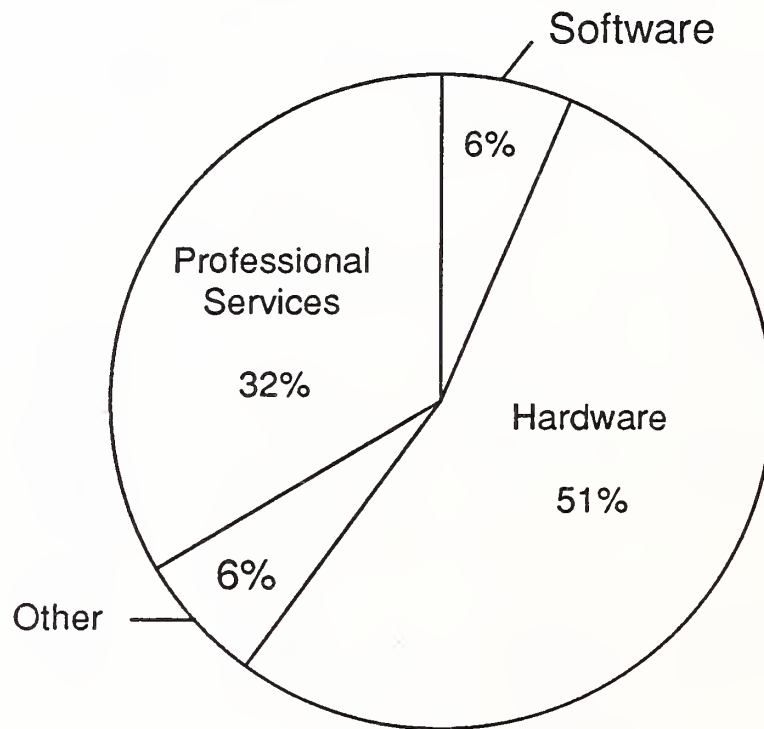
#### f. Component Group Expenditures

The projects described in the commercial SI Project Data Base have not been consistent with the forecast illustrated in Exhibit III-10. Earlier, professional services appeared to lead slightly, but the addition of some very large factory automation and utility projects have moved the balance toward that displayed in Exhibit III-12. Hardware leads professional services by a substantial amount, and software accounts for eleven percent of expenditures, higher than the forecasted trend. The "other" component group is about five percent, as was anticipated.



EXHIBIT III-12

### COMPONENT GROUP EXPENDITURES, COMMERCIAL PROJECT SAMPLE, 1988



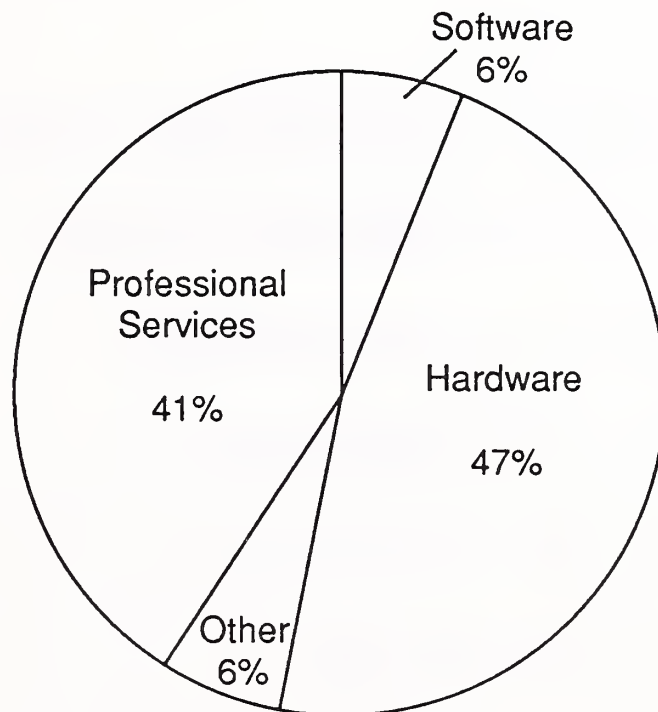
The federal project sample, depicted in Exhibit III-13 however, appears to track in reverse to the forecast model in relative distribution. Hardware and professional services expenditures are not equally different. Packaged software is about the same as the model, and higher than is generally expected from the government because of its preference for custom software. Since these ratios have been changing over the accumulation of project histories, it appears reasonable to assume eventual correlation in the five year period with the forecast in Exhibit III-10. This includes a gradual increase in the acquisition of packaged software by 1993.

### 3. Forecast by Industry

#### a. Annual SI Expenditures

The annual expenditures over the forecast period in the federal government market will grow from \$2.4 billion in 1988 to \$5.8 billion in 1993, at a CAGR of 19 percent, as shown earlier in Exhibit III-5. The breakdown of the forecast by key agencies and major projects is provided separately in INPUT's report, *Federal Systems Integration Market, 1988-1993*, published in 1988.

## EXHIBIT III-13

**COMPONENT GROUP EXPENDITURES,  
FEDERAL PROJECT SAMPLE, 1988**

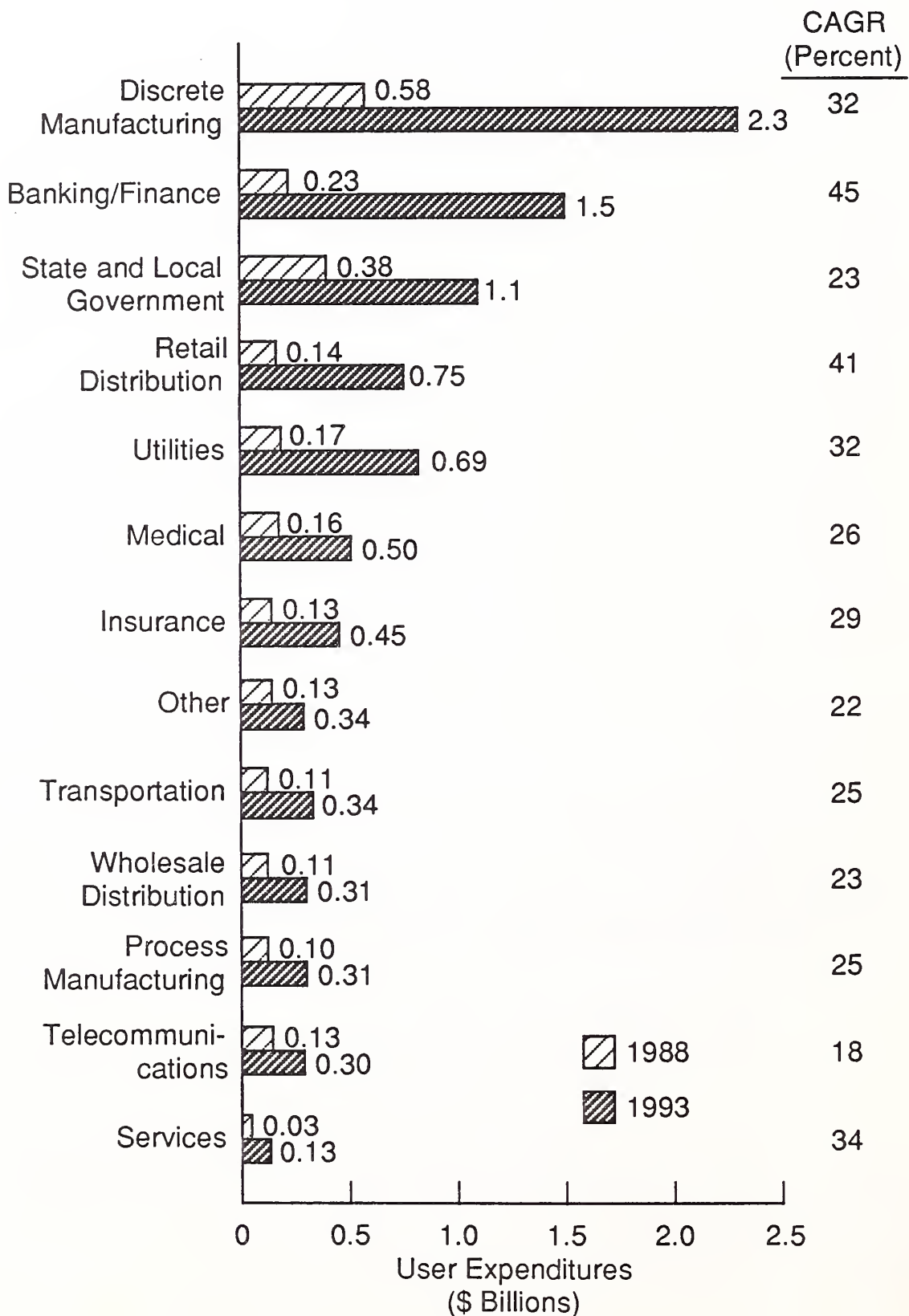
The annual expenditures by commercial industry sectors for the same forecast period is displayed in Exhibit III-14, and detailed by component expenditures and key opportunities in Section IV of this report. The top three industries, discrete manufacturing, banking/finance, and state and local government account for about one half of the total expenditures during this time period. Insurance, which was one of the top four industry sectors in the previous forecasts, dropped to seventh place, indicating a decline in the anticipated use of systems integrators in that industry.

The distribution industry sector has been divided into retail and wholesale, since the business problems are somewhat different and the expected rates of growth are significantly different, as noted in the exhibit.

The highest compound annual growth rates appear in banking and finance at 45%, and retail distribution at 41%. The growth rates of these sectors, based on their 1988 expenditures, will make them part of the four largest CSI markets by 1993.

EXHIBIT III-14

### ANNUAL CSI EXPENDITURES BY INDUSTRY, 1988-1993



At the other end of the growth rate scale, the telecommunications industry is expected to grow at a modest 18% because of the narrowing margins as the competition grows. The Other Sector of the industry has problems with geographic dispersion and small unit sizes, that lead to the second lowest CAGR of 22%.

The wholesale distribution industry is not expected to exceed a CAGR of 23% as it struggles with low margins, a tendency to run the business by intuition, and only moderate application of new information technology. The state and local government industry market is faced with tight tax-bound budgets and, at the smaller governmental units, a tendency to make improvements in a piecemeal fashion, leading to a growth rate of 23%.

#### **b. Comparison of U.S. and Western Europe**

The proportion of the total vertical industry market that key sectors occupy in the U.S. and Western Europe (WE) is shown in Exhibit III-15. For the leading industry in the U.S., discrete and process manufacturing have been combined, since the Western Europe report did not differentiate them. The non-federal government label was used for local government in the Western Europe report, and is referred to as state and local government in this report. Notable is the higher portion that Telecommunications occupies in the Western European market, which is still experiencing almost explosive growth since denationalization in several countries. The U.S. market is slightly more than double the size of the Western European market throughout the forecast period, as noted in Exhibit III-8.

## EXHIBIT III-15

**COMPARISON OF U.S. AND  
WESTERN EUROPE CSI MARKETS,  
BY VERTICAL INDUSTRY  
PERCENT OF MARKET, 1988**

Vertical Industry	Percent of Market	
	U.S.	Western Europe
Manufacturing	28	33
Non-Federal Government	16	10
Banking/Finance	10	22
Utilities	7	6
Telecommunications	5	11
Transportation	5	5
Other Sectors	29	13
Total	100	100

**c. Annual CSI Contract Award Values**

The total contract value of CSI projects, representing the value of new projects awarded in any year, is forecasted to grow from \$4.2 billion in 1988 to \$14.3 billion in 1993 at a CAGR of 28 percent. As expected, the five leading industries in total annual awards are the same as those in annual expenditures, as illustrated in Exhibit III-16. The last three industries are nearly the same, but in a different order.

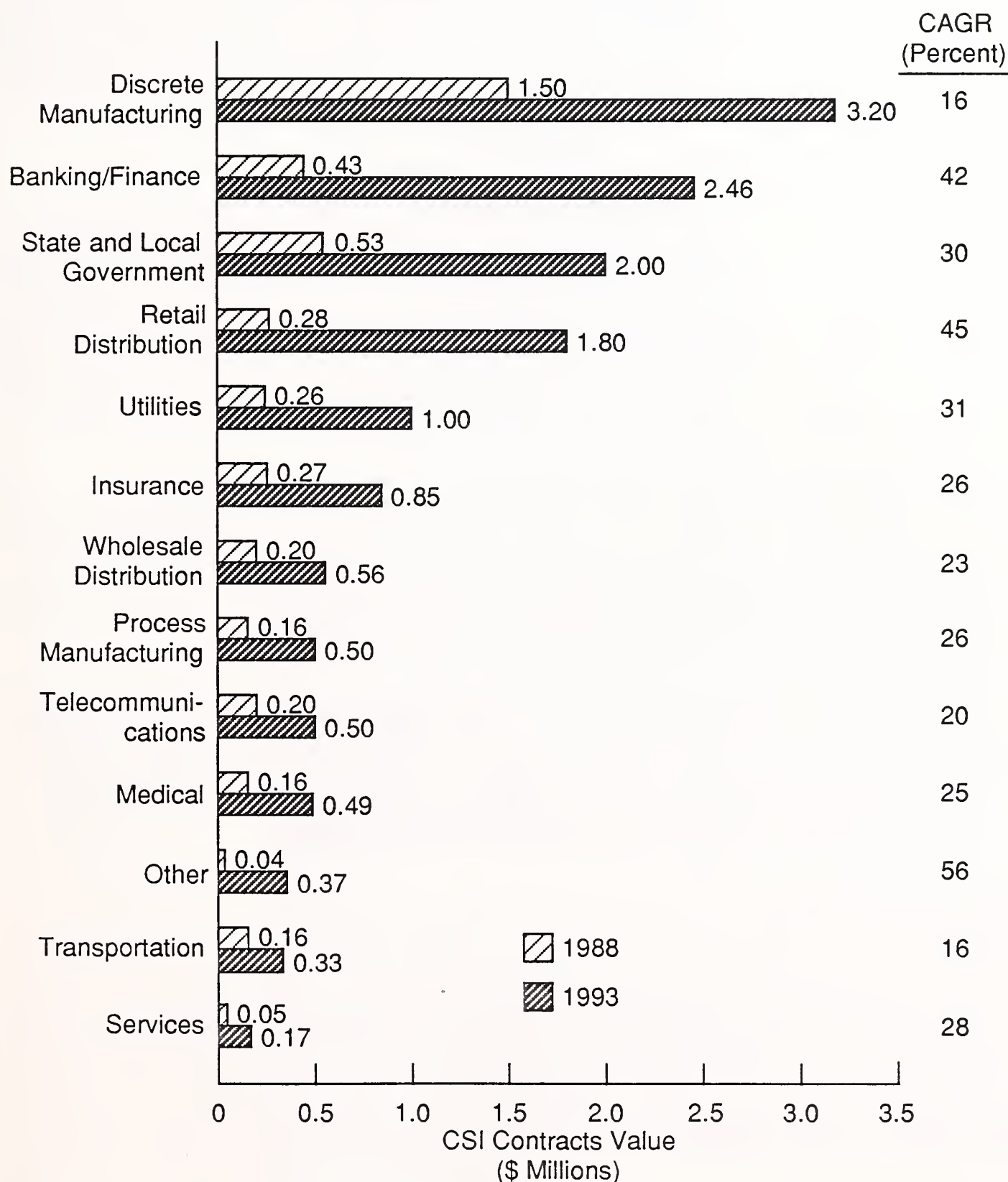
The difference between annual expenditures and annual awards does represent a direct relationship. The expenditures include outlays for contracts awarded one to three years earlier, and only a portion of the expenditures from awards are made in the current year.

The CAGR of awards varies according to the rates of annual expenditures because some industries use shorter contracts, while others imple-



## EXHIBIT III-16

# TOTAL ANNUAL CSI CONTRACT AWARD VALUES BY INDUSTRY, 1988-1993



ment SI projects in phases or smaller segments. Many of the users indicated a preference for smaller projects that could be more readily monitored, and that cause less disruption to the business during implementation.

The current examples in the SI Project Data Base include shorter-term contracts that have been or were expected to be implemented in less than three years, and a few very large contracts that have terms of more than four years. The types and ranges of opportunity associated with each vertical market are discussed in Section IV.

#### **4. Market Distribution by Cross Industry**

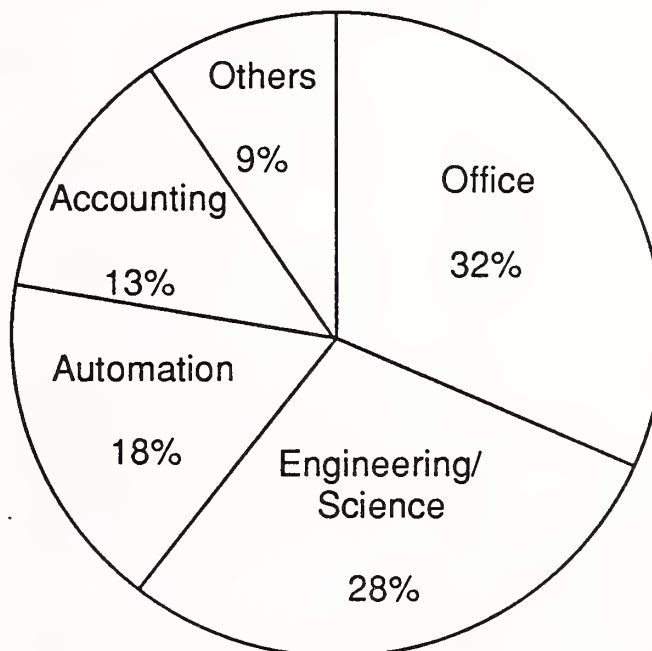
As found in the *Annual Information Industry Analysis* conducted by INPUT, a substantial amount of contracting for products and/or services is not industry-specific. Instead, it can be characterized as cross-industry, in that the business function occurs in at least a number of industries, if not all, in essentially the same or very similar form. Analysis of the SI Project Data Base developed during 1988 provided insight into at least three classes of cross-industry systems integration projects. Details on these "horizontal" systems and the vendor specialists are provided in Section V, which analyzes the data base.

Certain of the cross-industry sectors are clearly CSI projects, as noted in Exhibit III-17. Office systems account for 32% of the projects in the sample. The total value of the projects in the sample is \$1.5 billion, about one-third of the 1987-1988 contract award values. Office system projects appeared in nine of the vertical industries, but that does not rule out additional projects in the other six industries.

Engineering and science systems were a surprising 28% of the projects in seven industries. Automation projects represented 18% and appeared in discrete manufacturing, state and local government, retail distribution, process manufacturing, and one project in the sample for wholesale distribution. The remaining cross-industry projects were small and scattered among less than five vertical sectors.

## EXHIBIT III-17

### CROSS-INDUSTRY MARKET DISTRIBUTION COMMERCIAL PROJECT SAMPLE, 1988

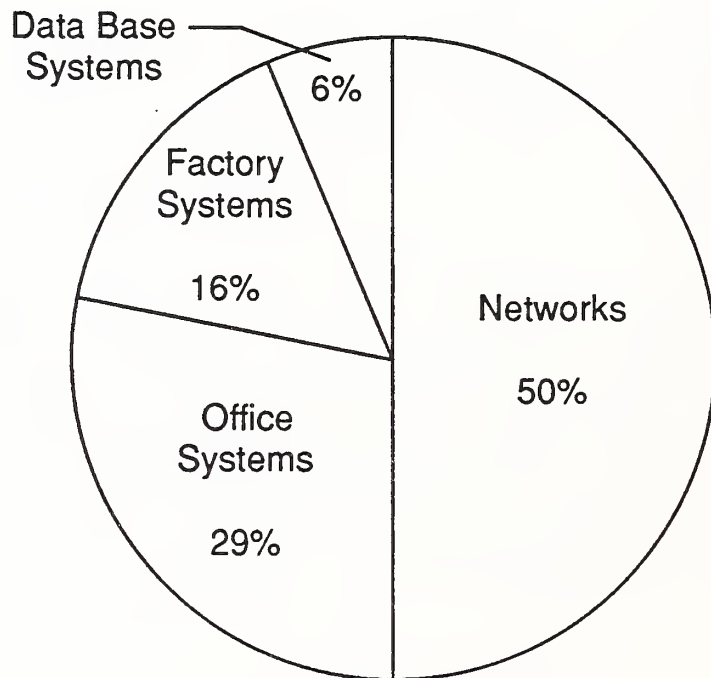


The notion of infrastructure integration was developed in discussions with several of the SI program clients during the latter part of 1988. As defined earlier in this section and in the data base analysis in Section V, integration of an infrastructure provides the IS organization with a platform to support new user requirements, and provide for a variety of on-line data bases, while meeting executive and decision support system needs. The four classes of infrastructure are noted in Exhibit III-18, which also indicates the distribution of the respective integration projects. Integration of the network infrastructure was the dominant activity reported in the data base (noted in eleven vertical industries). Project values ranged from \$5 million to \$268 million.

Although office systems was the largest cross-industry project class, only 29% of the infrastructure programs concerned integration of existing and new office information systems. Factory systems involving front office, sales, production control, and MRPII were smaller in number than the cross-industry automation class, principally because the infrastructure only applies to manufacturing. Despite a large number of data projects in the data base, only six percent provided for integration of the primary data infrastructure. As discussed in Section V, infrastructure integration may increase as the IS management recognizes the need to support broad corporate requirements.

EXHIBIT III-18

### INFRASTRUCTURE INTEGRATION PROJECT DISTRIBUTION COMMERCIAL PROJECT SAMPLE, 1988



Does not add to 100% due to rounding

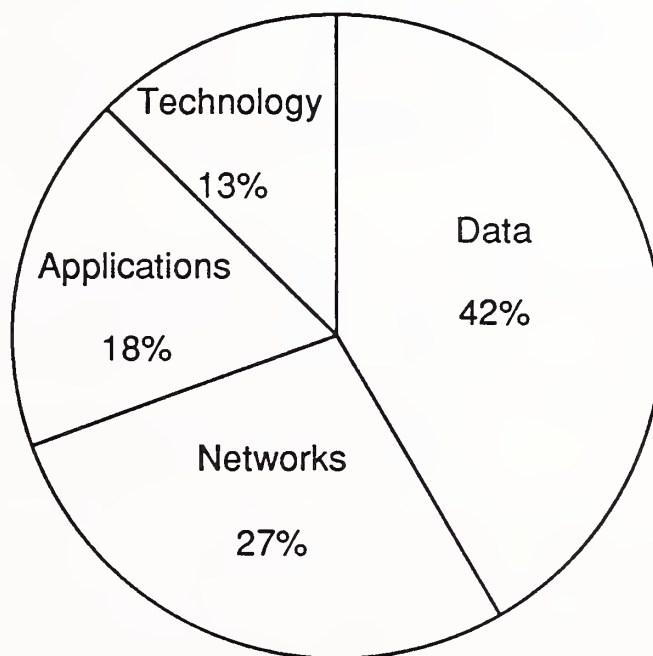
Another concept introduced at the 1987 INPUT Joint Client Conference on Systems Integration was that of project focus, which leads to evaluation of potential markets by specialists desiring to work in the cross-industry mode. When first introduced, the three components were applications, data, and networks. In 1988, technology was substituted for networks for a short period, because of the similarity of vendor type and skill requirements. The joint component of networks/technology described in Section V have been separated for analysis. The results of the application of the concept to the entire data base are presented in Exhibit III-19.

It was noted that data-focused projects were dominant, although most were valued in the \$6 million to \$20 million category with only three of greater value. Data-focused projects appeared in eleven industries, with insurance and state and local government leading in number of projects. Network-focused projects placed second, at 27%, and appeared in ten industries, with the largest number overall. Only telecommunications, utilities, wholesale distribution, and other industries had no network-focused projects represented in the data base.



## EXHIBIT III-19

### FOCUS PROJECT DISTRIBUTION COMMERCIAL PROJECT SAMPLE, 1988



The applications-focused group, at 18% of the sample, was the most pervasive, appearing in every vertical industry. The largest number of projects occur in state and local government, which also supported the largest group of network-focused projects. Technology-focused programs were fewer, appearing in only seven industries, the seven leading industry markets, however.

## C

#### Key Marketplace Factors

From the vendor viewpoint, systems integration projects represent new or additional opportunities for additional revenue. SI opens new distribution channels for the sale of products and services. The major vendors gain additional income from fees for managing the product and the subcontractors, and for some, the additional work of operating and maintaining the systems after implementation.

The close business relationship that develops between the integrator and the client, and the integrator's increasing understanding of the client's business needs, can assure the integrator of an "inside track" for providing future hardware, software, and services, including some which may not be related to the SI project.

Strategically, the SI client may be a different class of user to the vendor, with decision centers placed higher in the client's executive management, and to which the vendor needs increased exposure. The client may need to be sold on the benefits to his/her company and contributions to marketshare, higher margins, and survival.

This subsection explores the key advantages and hindrances, both current and future, to vendors participating or planning to enter the SI market, from the perspectives of the clients and vendors.

### 1. Key Commercial SI Market Factors

The use of integrators for the development of major systems has been fairly common practice in the federal government sector for more than 30 years. The commercial sector began to use outside vendors for integration in the last few years. As noted in the forecast subsection, INPUT anticipates use of systems integrators to expand over the next decade, for the reasons noted in Exhibit III-20.

EXHIBIT III-20

#### KEY COMMERCIAL SI MARKET FACTORS

##### Positive:

- Rising demand for connectivity
- Major rebuilding of infrastructure
- Growing user management trend
- Globalization of competitive pressures
- Growing complexity of applications

##### Negative:

- "In-house" competitive threat
- Growing concerns over maintenance issues
- Organizational instability
- "Wait-and-see" track records

On the positive side, the most significant factor is the rising demand for connectivity between business elements, trading partners, customers, and sources of supply. It involves the solution of equipment and protocol incompatibility problems, provision of cost-effective solutions, and implementation of network management systems, when needed. The time value of information has become as critical to business as the time value of money. The need for major rebuilding of the network and data infrastructure to provide the flexibility and capacity to satisfy new user requirements and decision support systems is becoming an important focus of IS managers.

The globalization of competition will force business to expand its real-time operating mode around the clock as well as around the globe. Most business systems are not equipped to meet the strain of continuous operation. New applications to cope with new problems are becoming more complex in the use of tools and data bases, beyond the capability of equipment more than a few years old.

Some factors are currently hindering the implementation of integrated systems. The most difficult hurdle for vendors is the perception of corporate management that the in-house staff is best qualified and most trustworthy to plan and execute important information system improvements. Organizational instability, the bane of many medium to large businesses, can indefinitely delay plans to upgrade or replace existing data processing resources. "Wait-and-see" attitudes are likely to be the most difficult obstacles for vendors to overcome.

## **2. Key Federal SI Market Factors**

Systems integrators have found a number of advantages to working for the federal government that outweigh the many unbusiness-like practices and competitive stresses. With little or no ADP staff growth, agencies look to industry to provide the answers and the systems to help satisfy steadily increasing demand. The agencies specify more details of the solution and employ a variety of monitoring practices, yet share the implementation risk with the vendors. Equally important, the Administration openly supported technologically-based upgrades under REFORM 88 and other initiatives, as noted in Exhibit III-21.

There are some concerns about the state of this market under a new administration and a single-majority Congress, in the face of budget limitations, and the threat of project cuts under the Gramm Rudman Act. For some vendors, failure of the government to implement standards has been a boon to competition; for others it has produced an element of uncertainty. Repetitive extensions of implementation schedules, especially for the medium to large multisite projects, can generate concerns of termination because of funding cuts, or different requirements.



## EXHIBIT III-21

**KEY FEDERAL SI MARKET FACTORS****Positive:**

- Demand for productivity improvement
- Shortage of technical staff
- Shared implementation risks
- Trend toward technology upgrades

**Negative:**

- Deficit and budget pressures
- Systems maintenance resource burden
- Slow standards implementations
- Extended implementation schedules

**3. Major Buyers Issues**

Although earlier surveys conducted by INPUT produced a number of client reactions to contracted systems integration projects, the initial report of the 1988 SI Program, "Buyer Issues," provided some fresh insight into buyer concerns. The research confirmed rising management expectations in many industries. In some, executives brushed aside in-house proposals and contracted for major solutions, to get them started early and with minimal internal modification. Users now want systems that perform functions for them without direct involvement of the IS staff, as noted in Exhibit III-22.

Corporations want information executives (CIO-Chief Information Officer) to be responsible for managing the technology investment and building the new system. The more astute IS managers see the urgent need for infrastructure integration in order to provide them with capable platforms for supporting new demands. Businesses are moving from general data processing to decision support and control systems that provide them with an appropriate competitive edge.



## EXHIBIT III-22

**MAJOR BUYERS ISSUES—1988**

- Rising management expectations
- User demands for increasingly complex solutions
- Managing the technology investment
- Integration—data/applications/technology
- "Mission-critical" solutions

Vendors will need to focus on the business application, to suggest improvements to the process stream, and to be concerned about the "cultural shock" potential of the introduction of radically different systems. The vendor must be sensitive to the client's perspective that the integrated systems solution is "mission critical" to the client's continued economic survival.

**4. Major Vendor Issues**

The SI vendors have also noted in surveys and conferences their concerns about this market. The major issues are listed in Exhibit III-23. A key concern is the omnipresent potential of catastrophic failure and the eventual litigation, a tarnished image, and the increasing liability insurance premiums. Coupled with this concern is the all-too-frequent resistance to change from the in-house integrators, who view the project as an encroachment into their territory.

Increasing competition for significant projects and the rush by the client to upgrade the solicitation ground rules could cause considerable confusion for client and vendor alike. Mixed signals could result in an inappropriate response and potential contract loss. Alliances have become highly touted as a means of satisfying the unique needs of certain classes of clients and industries.

The alternatives to, and short comings of, alliances will be discussed a little later. The concern, however, is that today's ally may become tomorrow's competitor, now armed with the vendor's business strategies

## EXHIBIT III-23

**MAJOR VENDOR ISSUES—1988**

- Potential of catastrophic failure
- Resistance from in-house integrators
- Increasing competition—confusion
- Competitive exposure through specific project alliances
- Leading-edge technology risks

and appraisal of internal skills. The potential for inadvertent exposure to pricing strategies threatens the prime contractor, partners, and suppliers. The medium to large SI vendors have serious reservations about the introduction of leading-edge technology in a project, with the potential for delaying the project, causing overruns, or, by far the highest risk, not meeting the promised specifications.

The INPUT Western Europe SI report also listed vendor challenges which are discussed in Section VI of this report. The principal challenges include: bidding, project management, and risk containment, as shown in Exhibit III-24.

The two most important elements in bidding involve costs and skill set. These are influenced by the client's perception of what is acceptable and the direction taken by the competition. Even in sole-source contracts, there is an upper limit to the price the client will pay, and tradeoffs between product and service costs and sales price must be made. The level of the skill set to be used is a tradeoff between cost realism and the quality to assure success. Project management is a key issue to the user/buyer, as well as the vendor. Managing day-to-day relations with the user is frequently essential to successful completion of the project.

Risk containment is a major challenge to federal clients as well as vendors. In the commercial sector, the cost of liability insurance will reflect the vendor's past performance as compared to his competition. Cost and resulting risk control measures must be part of the SI project management procedures for all of the SI vendor's staff.

## EXHIBIT III-24

**WESTERN EUROPE  
SI VENDOR CHALLENGES**

- System integration bidding
  - Costs
  - Skill set
- Project management
  - Managing the user
- Risk containment
  - Cost premium
  - Companywide responsibility
  - User benefit

Few vendors have the range of industry-specific and information skills in-house to successfully penetrate any industry in depth, or provide systems in the cross-industry modes. The key to near-term success involves the development of alliances to provide a fully rounded capability to the clients. Many companies have entered into alliances without having planned a workable arrangement in advance. Problems that plagued the AT&T-Olivetti alliance, as described by Dr. Michael Koza in the mid-summer 1988 INPUT SI Seminar, are listed in Exhibit III-25. Other experts at graduate business universities have made similar statements.

Throughout the duration of alliances, there can be doubts about the ally's commitment to the line of business for which the alliance was formed. The costs, both direct and indirect, are rarely detailed with any degree of reliability. This leads to economically or competitively derived unwillingness to share key assets. One or both of the parties may not realize the benefits which were initially seen as the basis for forming the alliance. The negative effects of the differences in business, sales, and management cultures have been traumatic in several failed alliances.

## EXHIBIT III-25

**PROBLEMS OF VENDOR ALLIANCES**

- Impact of environmental forces (\$)
- Short-term differences in performance
- Perception of benefits vs. actual benefits
- Possible unwillingness to share key assets
- Difference in culture

There is never any guarantee that all alliances will work for both parties. However, prospects for making them work for short periods of time can be improved. Exhibit III-26 lists a few of the steps that have helped the more successful alliances.

## EXHIBIT III-26

**HOW TO MINIMIZE ALLIANCE FAILURES**

- Clearly determine common objectives
- Communicate strategy to operating people
- Avoid complexity
- Insulate alliances from partners

Common objectives should be negotiated and clearly stated before the agreement is confirmed. The agreement needs to specify that no changes to the objectives will be made before a minimum period of time, since changes invariably lead to trouble. Communication of strategy, objectives, and procedures to the operating people, as well as management, is



essential. Dr. Koza suggested that the partners should consider the problem involving how and when to dissolve the alliance at the time it is confirmed.

## 5. Future SI Market Trends

Strategies currently being developed must consider possible future market trends and their impact on the company's posture and market share. While there are a number of potential alternative scenarios, the six scenarios with the most significant impact are listed in Exhibit III-27. Strategies to deal with these trends are considered in Section VI.

EXHIBIT III-27

### FUTURE SI MARKET TRENDS

- Entry of new domestic and off-shore competitors
- Market "hype" will blur definitions
- Increased centralization of vendor SI "product management
- Growing investment in marketing/promotion
- Development of formal market strategies by non-SI vendors
- Telecommunications companies

The projected growth and expected pervasiveness of information systems integration activities in most lines of business, academia, and government have attracted the attention of a new generation of domestic and offshore competitors. Management consulting, aerospace, and defense firms are looking to SI as an important growth industry.

Non-information industry participants are seeking entry into the market via mergers and acquisitions as exemplified by Emhart with PRC and ATI, defense firms such as Ford Aerospace with BDM, and aerospace firms such as Lockheed and Hughes. Organizations in Western Europe and the Pacific Rim, particularly in Japan, are forming alliances with

major U.S. vendors and quietly acquiring small pools of experts in domestic companies.

Almost every vendor, market analyst, or large client has a favorite definition for SI and its components, that seems more like "hype" than reality. However, INPUT believes that SI represents a disciplined approach to systems implementation.

A widening range of vendors has begun to centralize their SI skills and management. The objectives include developing a "critical mass" to perform the tasks, provide a publicly supportable image as an SI vendor, control costs and risk, and provide enhanced visibility of project progress.

More of the vendors have begun to recognize the need to promote their SI and/or SI support capabilities and successes, especially in the CSI market. The approach that pertains to business solutions will gain favor because it appeals to higher-level, non-technical management.

Marketing of products, services, specialties, and tools is expected to become critical. Suppliers and subcontractors will increase the level of product and service visibility to levels above the purchasing officer, in order to gain a foothold in tactical and strategic market planning. Like federal clients, the primes will increase communications with partners, allies, and suppliers to increase their involvement in project conduct.

Vendors who are not identified with the SI market are expected to develop market strategies to enter or widen their position in the SI market. Some will approach known SI competitors; others with unique products or services will address prospective clients directly, hoping for a directed position in a potential contract.

Current market participants are expanding their range of services and products to allow them to take on a greater share of the projects. Of this group, the most aggressive segment with "deep pockets," involved with almost all classes of clients and with a strong desire to diversify, is the telecommunications industry. If the formula being developed is successful, these vendors could become key players in future SI projects.

## D

### Competitive Environment

The attractiveness of SI in terms of its revenue potential and account control characteristics is leading to a sizeable number of vendors claiming that they are systems integrators. A far fewer number by INPUT's definition are true integrators able to plan and manage major projects that result in successful delivery of solutions to client organizations.

While many information services sectors support a large number of participants, CSI, like FSI, is likely to become a heavily concentrated

business because of the size of projects and the technical demands. Casual participation is very unlikely.

The promise of rapid growth in the SI market is likely to attract large and respected competitors. However, the combination of newness, large competitors, and intrinsic tensions on the customer side are resulting in very demanding market conditions, as noted in the previous subsection.

Since no firm currently has a "franchise" in this market, the opportunity exists for vendors to create niche markets from their particular position of strength. Eventually, the end result will be strategic alliances among different classes of vendors.

INPUT discusses the leading competitors of 1988 by revenue, market share by vendor class, and emerging trends in this subsection. Secondary SI market vendors will also be discussed with a view toward their probable impact on the market.

An in-depth analysis of the results to date, market penetration plans, industry focus, and market strategies of the key SI vendors will be provided in a separate report entitled, *Systems Integration Competitive Analysis*.

## 1. Market Share by 1988 Revenue

INPUT estimates of vendor market share in 1988 for the U. S., and for comparison, Western Europe, are presented in the next four exhibits. Some of the revenue figures have changed substantially since the last conference and the 1986 report. This report includes a full year of data since the last report. There have been some changes in ranking in the total U.S. market, as presented in Exhibit III-28. The list has also been extended to fifteen vendors because more data became available and there were queries about companies not ranking in the top ten.

The interesting changes include a higher revenue figure for the leader IBM, and a proportional increase in market share. Unisys has improved its position from seventh to fifth place; SAIC has moved to sixth place; Grumman Data Systems has moved ahead of CDC and SHL Systemhouse; and BCS and PRC/Emhart have improved sufficiently to join the leading ten U.S. market vendors.

By industry classification, the top five overall vendors include two hardware firms, two professional services firms, and one "Big Eight" firm, all of which have established business strategies for growth through penetration of both vertical and cross-industry markets. Between them, they account for 52% of the market shares.



## EXHIBIT III-28

### TOTAL U.S. SI MARKET SHARE BY REVENUE, 1988

Rank	Vendor	Market Share	
		\$ Millions	Percent
1	IBM (FSD/CSO)	850	18
2	EDS/GM	505	12
3	Andersen Consulting	383	8
4	Computer Science Corp.	345	7
5	Unisys	335	7
6	SAIC	280	6
7	Grumman Data Systems	250	6
8	Boeing Computer Services	200	5
9	Control Data Corp.	180	4
10	PRC/Emhart	159	3
11	Digital Equipment Corp.	140	3
12	AMS	116	2
13	SHL Systemhouse	91	1
14	AGS/Nynex	80	1
15	MMDS	80	1

In the list of top fifteen, seven companies are value-added professional services firms, three are aerospace spin-offs, four are hardware companies, and one is a "Big Eight" firm (Andersen Consulting). Three companies have been acquired by firms not in the computer field, and three are spin-offs from very large in-house data processing organizations. All firms have extensive professional service experience, and a number perform facility management services. Both of these capabilities appear to contribute to their bidding successes.

It becomes quite evident that only IBM and EDS hold key market shares when a comparison is made of the respective ranking of vendors in the commercial and federal markets. Exhibit III-29 displays the relative rank



of the commercial SI market vendors. Andersen Consulting holds a prominent position in this market, and has the widest cross-industry penetration. Unisys retains a key position, tied for sixth place with Digital.

## EXHIBIT III-29

### U.S. COMMERCIAL SI MARKET SHARE 1988

Rank	Vendor	Market Share	
		\$ Millions	Percent
1	IBM	400	17
2	Andersen Consulting	338	14
3	EDS/GM	155	7
4	CDC	120	5
5	AMS	103	4
6	Digital Equipment Corp.	100	4
6	Unisys	100	4
8	AGS/Nynex	70	3
9	CSC	45	2
10	PRC/Emhart	43	2
11	SHL Systemhouse	37	2
12	CTG	30	-
13	BCS	25	-
14	McDonnell Douglas	24	-
15	SAIC	15	-

Among the vendors who have respectable market positions in the commercial sector are AMS, AGS/NYNEX, AND CTG, who do not have extensive contracts in the federal SI market, although AMS and AGS are involved in professional service contracts for federal agencies. Some of the top fifteen, such as CSC, SAIC, BCS, and PRC/Emhart, who have high rankings in the federal market, have started to penetrate the commercial market. CSC's strategy has been the acquisition of highly skilled firms such as Computer Partners and Index Systems.

In the earlier analyses of the differences between the government and commercial SI markets, there was an emphasis on the marked differences in business conditions that would foster a separate class of vendors in each. Exhibit III-30 clearly indicates that the major vendors are bridging the two sectors. Eleven of the leading fifteen vendors also appear in the top fifteen of the commercial market list.

EXHIBIT III-30

### U.S. FEDERAL SI MARKET SHARE 1988

Rank	Vendor	Market Share	
		\$ Millions	Percent
1	IBM	450	17
2	EDS/GM	350	13
3	CSC	300	11
4	SAIC	265	10
5	Grumman Data Systems	250	9
6	Unisys	225	8
7	BCS	175	6
8	PRC/Emhart	116	4
9	MMDS	80	2
10	FDC	80	2
11	TRW	78	2
12	CDC	60	1
13	McDonnell Douglas	56	1
14	SHL Systemhouse	54	1
15	Andersen Consulting	45	1

CSC, SAIC, GDS, and Unisys have increased their share of the federal market since 1987, while BCS, PRC, and MMDS still retain their previous year's share. Over the next few years, the high ranking of these leaders may continue with revenues from the awards of large FAA, IRS, and NASA multiyear SI contracts.

Vendors with extensive government experience have learned to operate with smaller mark-ups or fees than is common in the commercial market. The leading firms have developed sophisticated program methodologies and are accustomed to providing frequent oral and written reports to clients under the discipline of government procurement regulations. These practices and the resulting project visibility are welcome additions to commercial project practices.

Earlier, under future trends, the prospect of new overseas competitors was listed as an increasing challenge to U.S. SI vendors. The trend is not a one-way proposition; Exhibit III-31 from INPUT's *Western Europe CSI Market* report clearly indicates that it is working in both directions.

Among the European firms identified in the U.S. market are Cap Gemini Sogati (CGS), SD-Scicon, Sema Group, ICL, Philips, and GPT. U.S. SI firms with European subsidiaries include IBM, Unisys, Andersen Consulting, Digital, EDS, and Tandem. The size of the shares drop fairly substantially in the INPUT-U.K. survey, with only two vendors with double-digit shares, and a six percent share for the third ranked vendor, Siemens. Note also that the Western European CSI market in 1988 is slightly less than half that of the U.S.

## EXHIBIT III-31

### WESTERN EUROPEAN COMMERCIAL SYSTEMS INTEGRATION MARKET

Rank	Vendor	1988 Estimated CSI Revenues (\$ Millions)	Market Share (Percent)
1	IBM	190	17
2	Andersen Consulting	155	14
3	CGS/SESA	135	12
4	Siemens	65	6
5	SD-Scicon	60	5
6	Unisys	55	5
7	Logica	50	5
8	Sema Group	45	4
9	Ferranti	35	3
10	Digital	30	3
11	SSL*	25	2
12	ICL/STC	25	2
13	Olivetti	20	2
14	EDS	20	2
15	Tandem	17	2
16	Mannesman	15	1
17	Philips	12	1
18	GDS**	12	1
19	Racal	11	1
20	GPT†	10	1
	Others	133	11
	Total	1,120	100

\*Software Sciences Ltd.

\*\*Grumman Data Systems

†GEC Plessey Telecommunications



## 2. Market Share by Class of Competition

The 1988 commercial SI market shares of the industry competition classes, shown in Exhibit III-32, have changed significantly since the 1986 INPUT report. The professional services share has increased from 28% to 36%. The "Big Eight" and management consultants share has increased by almost 15%. Although the revenues of hardware manufacturers have risen, the market share has fallen from 48% to 30%. The share of the other class, which includes engineering, construction, and electronics firms, fell from 19% to 7%.

EXHIBIT III-32

### MARKET SHARE BY CLASS OF COMPETITION UNITED STATES, 1988

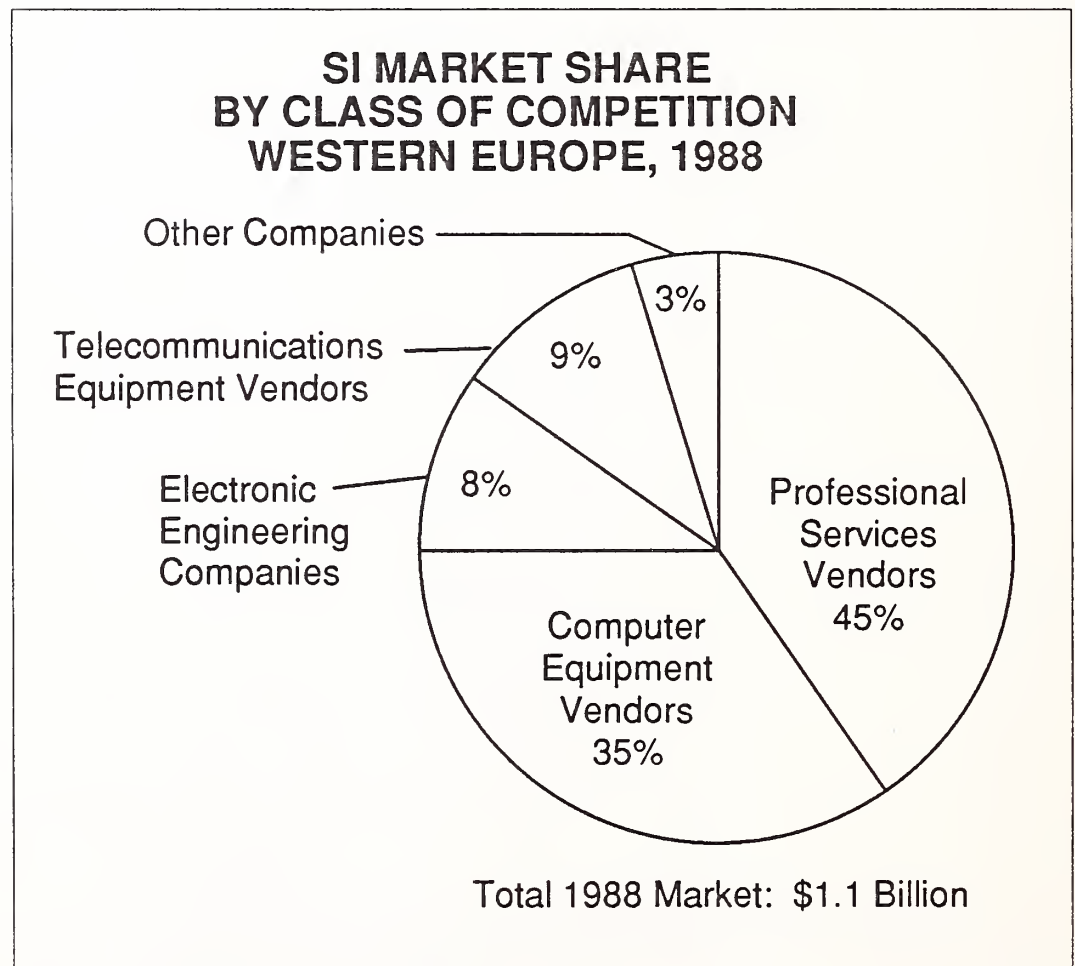
Vendor Class	Percent of Market		
	Federal	Commercial	Overall
Hardware Manufacturers	28	30	29
Communication Vendors	3	11	7
Professional Services	40	36	38
Management Consultants	3	15	9
Aerospace	21	1	11
Other	5	7	6
Total	100	100	100

One note of caution is needed here. The market share by competitive class in this exhibit is not comparable to the expenditures by component displayed in Exhibits III-9 to II I-13 in subsection B, earlier in this section. The component statistics relate to hardware, software, and services which are provided by most of the vendors, but in varying proportions based on the vendor's industry classification.

The exhibit also illustrates the higher share of the aerospace vendors in the federal market, as compared to the commercial market, and the reverse emphasis of communications vendors in the commercial market. The management consultants also had a much greater share of the commercial market, by a factor of five, reflecting the progress made by firms such as Andersen Consulting and American Management Systems.

Exhibit III-33 is reproduced from INPUT's Western Europe report to provide some comparison with the statistics generated by revenues in the U.S. Professional services firms lead hardware firms by five percent, and between them represent three-fourths of the \$1.1 billion market. Telecommunications equipment vendors appear to have about the same share as in the U.S., which is largely attributed to the denationalization of the industry in Europe. The category of electronic engineering companies is included in the other category in the U.S. comparison. Note that management and accounting (Big Eight) firms are included in the Western European classification of professional services.

EXHIBIT III-33



Analysis of the SI Project Data Base and the survey of vendors for the separate competitive analysis report provided another clue to the reasons for the relative success of the leading SI vendors. Exhibit III-34 lists the number of vertical industries that the leaders appear to have penetrated. "Appearance" is an appropriate description because some cross-industry firms declined to identify the vertical industries in which they have projects.

EXHIBIT III-34

### LEADING SYSTEMS INTEGRATION VENDORS, VERTICAL INDUSTRY PENETRATION

Vendor	Number of Industries
IBM	12
EDS/GM	10
Andersen Consulting	8
SHL Systemhouse	6
CSC	5
AT&T	5
Unisys	3
BCS	3

The obvious leader is IBM with projects in 12 of 13 vertical-industry sectors. The range of penetration has been a deliberate strategy of IBM, and obviously an ongoing commitment with the formation of the Systems Integration Division in 1988. EDS/GM, Andersen Consulting, and SHL Systemhouse, although widely distributed in the size of SI projects, are nevertheless considered competent and frequent bidders by a number of vendors interviewed for the *Systems Integration Competitive Analysis* report.

Exhibit III-35 provides examples of the vendors in the vendor classifications, with some expansion of the software and professional services classes. This exhibit is intended to provide some examples and is not a definitive listing. There might be some value in developing such a compilation, but there are some inconsistencies involving the classifica-

tion to use for several of the SI vendors. A list based on the project data base is included in the latter part of Section V-Data Base Analysis.

EXHIBIT III-35

### SYSTEMS INTEGRATION VENDORS, CLASSIFICATION EXAMPLES

Category	Examples
Hardware Producers	IBM, Digital, Unisys, CDC
Communication/ Network Suppliers	RBOCs, AT&T, Contel
Professional Services	Arthur Andersen, CSC
Custom Software Developers	Systemhouse, Computer Task Group
Systems Suppliers	BCS, EDS/GM, MMDS
Application Software Suppliers	BIS Banking Systems, Inc.
Systems Software Suppliers	Oracle, Pansophic
Federal Systems Integrators	EDS, CSC, PRC, American Management Systems

There is limited correlation between these categories and the classes of competition illustrated in Exhibit III-32. Professional services would include the categories (in Exhibit III-35) of custom software developers, system suppliers and some federal systems suppliers. MMDS and BCS would be included in the (Exhibit III-32) aerospace category.

A topic of concern to a number of vendors who appear to fit in a single classification is the expansion of some competitors beyond their traditional market focus. The principal classes of the last Exhibit (III-35)



were examined to uncover additional capabilities being acquired to address specific strategic targets. Exhibit III-36 presents the results of INPUT's inquiries.

EXHIBIT III-36

### EMERGING VENDOR TRENDS BY CLASS

Vendor Class	Additional Capabilities	Strategic Target
Professional Services	Data/Network	Vertical Industry Niches
Software	Professional Services (PS)	Applications Niches
Hardware	Software/PS	Full Range
Communications	Software/PS	Network
Systems Suppliers	Data/Network	Applications/Network

A number of professional service firms, especially those whose objective has been to cultivate the image of a "full-service vendor," have developed data and network capabilities. Earlier these capabilities were intended to support processing services and network services, but now they are being applied to vertical industry niches. Key examples are CSC, EDS, and PRC. Aerospace vendors like BCS and MMDS have similar capabilities.

Hardware vendors have developed strong alliances as well as dedicated in-house staffs to add software package and professional services skills, and are continuing to expand these skills to offer a full range of support. IBM, DEC, and Unisys have ongoing development activities in these areas. Software firms are moving toward in-house SI-oriented professional services, of which Oracle is a prime example. Communications firms are adding both software and professional services to expand network services into full-scale SI projects. AT&T and several RBOCs have made major investments in this strategy.

It is not clear how successful these expansion activities will be to improve market share in the long term. For some vendors, the newer capa-

bilities represent a substantial challenge to the traditional culture, and the expansion may fail if it is not successful quickly.

### 3. Secondary SI Vendors

The principal focus of most SI market discussions is the very large programs and the leading vendors. It is understood that many of the integrators also provide products/services to other integrators in alliances and partnerships and to in-house integrators. One part of the market not addressed in any depth is the role and revenue volume potential of those vendors that could be classified as "secondary."

As part of the *Annual Information Industry Survey and Analysis* of INPUT's Market Analysis Program, vendors were asked about their interest and involvement in the SI market. Fifty-nine respondents indicated a range of interest and/or revenues obtained from larger SI vendors and in-house integration projects. The results of the analysis are presented in Exhibit III-37, summarizing their perceptions and INPUT's evaluation of their capabilities.

EXHIBIT III-37

## SECONDARY SI VENDORS

### Perceptions

- High level of interest in SI—a new market
- Generally do not want to be prime contractor
- SI is a growing part of their business
- Know who major players are
- Want visibility to major players for specific capabilities

### Limitations

- Experience base is often limited
- No large project management experience
- Narrow technical skills
- Lack of financial resources
- If software or turnkey, restricted to own solution

Those vendors indicating some level of SI market involvement demonstrated a high level of interest in SI as a market for them to serve, but generally were not interested in assuming the risks of a prime contractor. They appear to know who the major players are, what industries are being addressed, and some of the key clients. The secondary vendors uniformly admitted to a need for visibility of their specific capabilities to major SI vendors and users, and an interest in finding better ways of making this happen in a focused manner. These vendors would like to develop longer-term relationships to become a part of key vendor teams.

The vendors in the sample have some limitations. Some or most of the limitations can be implied as applicable to most secondary vendors. From the SI vendor's viewpoint, these limitations could work to the prime vendor's advantage by minimizing the prospects for dealing with an eventual competitor. Most of the secondary vendors possess a narrow range or limited number of technical skills and often lack financial resources to carry fixed-priced jobs on the books for any length of time. Their experience base is often limited to a particular specialty. Software or turnkey product vendors are usually restricted to their own solution and not to a range of problems or applications.

Although the secondary vendor may not have large project management experience, it is usually committed to completing contracted tasks within budget, and can be motivated to play a reliable role as a supplier. There have been some negative secondary vendor experiences, however, with prime contractors who tried to shift a disproportionate amount of the risk onto the subcontractors, or who routinely cut prices after the prime contract was signed.

Several of the major SI vendors have implemented strong support vendor programs designed to maintain good relationships through continuing communications between projects as well as during them. Two-way dialogue is established. Suppliers and VARs are trained on new products/services and future developments, while the major vendor is kept informed of market changes, client problems, product difficulties, and supplier concerns about support, parts, and maintenance.

## E

### Technology Drivers

The market environment provides the more important economic drivers that support the projected growth of the SI market. Competition for market share and improvements that can increase margins now and in the future are the principal motivators for SI project initiation. Improvements in information processing have become attractive through the introduction of new and improved technology. The range of possibilities has widened substantially within this last half of the 1980s and portend the availability of increasing benefits to users.



Exhibit III-38 lists the major categories of evolving technology that can help to provide the processing power and flexibility desired by SI clients. There are several specialties also available for system designers that offer unique data processing capabilities.

EXHIBIT III-38

### SI TECHNOLOGY DRIVERS—1988

- Relational data structures
- Open systems standards
- Multiplatform software
- Microcomputer sophistication
- Communications product range

Relational data structures and the management software to support them allow rapid filing and retrieval of business information, production, and traffic control data and customer support functions. Open-system standards, as they are adopted, will substantially enhance connectivity and the addition of new sophisticated information transfer and presentation tools.

Multiplatform software is rapidly becoming an accepted commercial practice, and has been a federal government objective during most of this decade. The heavy investment in hardware of most mid- to large-scale multifacility installations makes the acquisition and maintenance of platform-unique software uneconomical. The move toward increasing end-user applications support will be easily attainable in an integrated system solution employing multiplatform software.

Increasing microcomputer sophistication, including the emergence of RISC machines and the new megabit chips, can provide more powerful workstations without seriously overloading existing mainframes. The new graphics applications will accelerate many factory automation and transport scheduling operations. Combined with new compact memory systems, these microcomputers will support wider application of artificial intelligence, new automated machinery via CIM, and a wide variety of decision support systems.



Application of microcomputers to optical fiber and resolution of protocol incompatibilities can now resolve many communication network problems. The increasing availability of network management hardware and software will encourage larger investments in multisite operations. The widening spectrum of technology-supported responses to business information problems is expected to fuel the use of SI vendors who know how to use the new technology effectively.



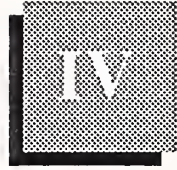


# Vertical Industry Markets for Systems Integration









## Vertical Industry Markets for Systems Integration

As noted in the previous section, vendors may address systems integration opportunities within particular cross-industry segments, vertical-industry markets, or both. This section will discuss the characteristics and key issues of each vertical industry, and the potential for systems integration projects.

In identifying and pursuing likely prospects, each SI vendor should be influenced by the following general characteristics:

- Sector susceptibility to systems integration contracting that results from the impact of a broad set of factors, such as internal and external market competition, regulations, capital investment funding availability, and the level of technical sophistication including the prospect of in-house integration efforts
- Extent and growth potential for information resources integration affected by the extent of automation, utilization of networks, moves toward centralization or decentralization of decision processes, relative age and variety of processing platforms and peripherals, and growth of end-user applications
- Trend towards user involvement in system design and operation that can seriously impact the extent of system acceptance, future utility and efficiency of the system, if not identified in the bid solicitation, and/or actively pursued by the vendor during the prosecution of the project. Varies in practice between different vertical markets.
- Vertical market vendor expertise that is essential to counselling prospective SI customers in how the processes used in the vertical industry will be influenced by the structure and changes in information systems and services requirements

- Sophistication and density of competition should be carefully investigated and evaluated to avoid competing with companies that have better-than-even chances of winning, bidding projects with certain types of uncontrollable risks, or bidding without the advantage of key alliances essential to the desired solution if the capabilities are not currently resident in the bidder's organization

## A

### Banking and Financial Services Industry

This sector covers four major areas including commercial banks, thrifts, security and commodity brokerages, and other financial services, such as credit unions, mortgage banks, cooperatives, and personal and industrial financial institutions. Insurance is discussed as a separate vertical sector.

#### 1. Industry Forces

Three major changes in the financial environment in this decade, occurring independently and in combination, have created trends that are changing the industry's image and methods of doing business. Several of these changes are influencing information processing applications. These changes include deregulation, the thrift crisis, and financial/demographic factors.

Changes in both federal and state regulations governing financial institutions have impacted the structure of the industry. A key example is the change in the business conduct of financial and banking institutions under the Depository Institutions Deregulation and Monetary Control Act of 1980.

The crises in thrift solvency brought on by mismanagement have severely impacted federal deposit insurance reserves, the roles of bank examiners and private audit firms, and the authority of state banking regulators. Changes in regulations are expected to continue into the 1990s as the federal government weighs the alternatives for bailing out distressed institutions.

Financial factors that drive the type and price of services offered have been influenced by a narrowing spread between the prices of deposits, including checking accounts and loans, a growing number of competitors, and the acceleration of the time value of money. The changing demographics reflect the globalization of financial interests and activities, demand of "one-stop banking," and around-the-clock, interactive/on-line/real-time services.

The principal trends of the industry's reaction to and/or compliance with these environmental changes appear to include the extension of existing institutional functions into multiple lines of business, combinations or consolidations of firms, especially for failing thrifts, and changes in offered individual products and services.

Extensions of business are exemplified by the expanded powers of banks and thrifts, the growth of diversified financial firms, and the expansion of financial services offered by brokerage and insurance firms. The most significant change is the entry of non-financial firms like Sears and Ford. Services and products offered range from ATM and credit cards to specialized checking and deposit accounts to brokerage and insurance from non-traditional institutions.

Ailing thrifts have been closed and offered for acquisition by outside investors and other financial institutions. Local institutions have merged with larger organizations to offer more services, to improve investment leverage, or to provide more stable operations. Regional and interstate banking is spreading, with improved and expanded availability of services for clients.

Individual products and services are changing in variety and expanding in coverage. These moves can be expected to continue into the next decade at a more rapid pace. Automated trading systems that are available around the clock are affecting the services of brokers and financial specialists. EDI, EFT and POS are changing payment mechanisms and helping to control banking costs.

The goal of the industry is full relationship-based banking that offers a portfolio including brokerage services, investment advice, money markets, and other nontraditional types of services.

## **2. Impact on Information Systems and Services**

The consolidation of financial institutions, extension and increased availability of products and services, and globalization of the industry have pushed information systems and services into a strategic role. These demands require the rapid movement of more data and information downstream to the customer and upstream to institutional management and banking regulators.

Regulatory changes, dynamic financial conditions, and the increasing range of services is placing enormous stress on the in-house IS staff. There are requirements for highly specialized experience for short periods, and infrequent opportunity to effectively use the specialization unless the institution is very large. In addition, the average life cycle of the current systems is becoming shorter, so that obsolescence is a constant threat.

Financial managers need more information and supporting analyses to make the decisions that will keep their firm competitive. Requirements now include frequent collection, assembly, and on-time delivery of financial data as needed. Integrated funds and cash management are essential to control consolidated cash flow.



Portfolio and credit services require interaction of customer services and account managers with most of the previously independent departments of financial institutions. Distributed data processing must be integrated with control data processing applications, employing standardized network protocols and systems architecture. New systems must provide interfaces for PC users with central computer facilities to allow combining of office tasks, financial processing, and service analyses by a single manager.

Expansion of access to a growing range of internal data by users and customers is increasing the necessity for data management. Control, integrity and security of frequently sensitive data are major concerns of banking and financial management.

### 3. CSI Potential

The potential for systems integration in banking/financial institutions continues to appear strong, second only to discrete manufacturing. The external pressures on information systems and services fuel the search for and implementation of critical new technology to core business practices as seen in Exhibit IV-1.

EXHIBIT IV-1

#### KEY FACTORS IN BANKING/FINANCE INDUSTRY

##### Positive:

- Shift to merchant banking
- Time-sensitive information requirements
- Growing body of PC-based end users
- Technical innovation desired

##### Negative

- Parochial view of in-house capabilities
- Opportunities hard to locate
- Industry and application experience required
- Platform-based system preference
- Network cost limits



Systems that are closest to the primary business (direct deposit and loans in banks, for example) are expected to continue to be the most active area of development. In addition, distributed data processing and electronic data interchange that facilitate the gathering and distribution of information will be the focus of significant activities. These systems are expected to include trust systems, centralized customer information systems, correspondent banking services, check processing systems, and commercial loan systems.

Loan analysis systems and platform officer support are examples where office automation and banking/finance applications may merge on a banking officer's desktop in the familiar PC. This industry segment has above average demand for applications software, communications hardware, and integration services. The deregulation of the industry in the first part of the decade spurred large banks and financial institutions to upgrade their hardware suites to more easily take advantage of new unregulated businesses. Demand continues for completing communications hardware purchases and integrating these systems.

Communications technology that offers lower error rates are particularly important as financial companies extend their reach across the country and around the world. National networks of ATMs and debit cards have become a competitive necessity. Other services that require extensive networking are expected to follow as the competitive nature of this market intensifies.

Applications software packages should continue to be popular in this segment. Many software vendors have targeted banking/finance as a growth industry for integrated applications. In fact, the market is so saturated with alternative products that many firms believe off-the-shelf solutions are the approach of choice. However, this addresses only the central application part of the software requirement and will not impede growth of CSI which addresses the entire integrated solution requirement.

There are several factors that can negatively affect the direction and speed of CSI development in this marketplace.

Like the majority of CSI prospects in other sectors, the in-house staffs will be the main competition, with strong temptations to "go it alone" in planning, managing, and executing large projects. Executives are more likely to favor the in-house staff because it is in a better position to understand their unique needs.

Opportunities are difficult to locate. The top 300 banks, while less than 3% of all commercial banks by number, account for over 60% of current information services expenditures. Similarly, the top 100 money centers and regional banks comprise over 40% of total information services spending. The next most active group is the medium-sized banks, about

12% of the total, but accounting for slightly more than 20% of IS expenditures.

The banking/finance industry requires highly sophisticated, industry-specific knowledge for successful systems development. Vendors must be able to integrate advanced technology into industry-specific applications knowledge. Vendors targeting the largest banking/financial services institutions also must be in a position to demonstrate internal capabilities.

User management in this sector believes that they are innovators in applying technology. While this is a positive position from the vendor's perspective, it does require that they meet high levels of expectations, even though some environments may require integrating past, current, and future generations of technology within the same environment. Buyers in this sector place a premium on the vendor's ability to understand requirements and demonstrate experience in the industry and in specific application areas. The issue of the vendor's ability to fulfill the demand of the CSI project does not become the primary issue until these experience-related criteria are met. Vendors should take care to match the buyers changing criteria in the sales cycle.

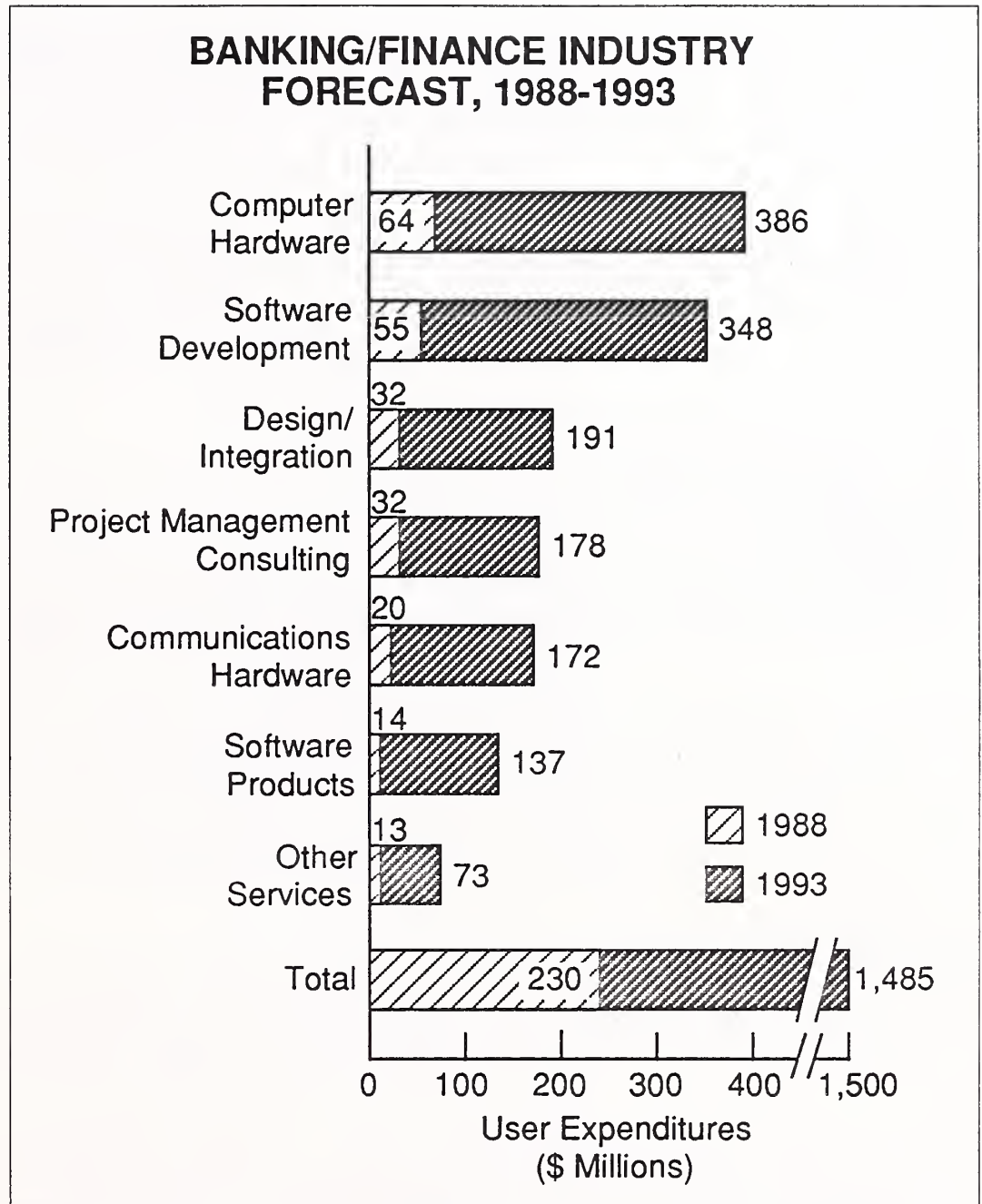
The management of security is a critical issue in this industry. Validation/authentication of messages in transaction networks and prevention of network infiltration and tampering are now an important aspect of systems development. The security issue also means opportunities for disaster recovery technologies, secure networks, and signature verification systems.

The demand for systems that automate the setup of new accounts and tie to integrated deposit systems that include ATMs on the user end and customer information files on the other end has sharply diminished in the face of the increasing costs of operating ATMs, and the dependence of smaller banks on others to provide the service.

#### 4. CSI Forecast

Exhibit IV-2 summarizes the main components of the industry's CSI market for 1988 to 1993. Computer systems will continue to be the single largest component of CSI expenditures as companies move to overcome the escalating obsolescence of current systems in meeting new service and product requirements. Systems will be followed closely by software development to substantially improve end-user use of the systems.

EXHIBIT IV-2



Design/integration and project management/consulting together will draw nearly as much expenditure as computer systems, growing to over \$360 million by 1993, and driven by the need for non-stop architecture, satisfaction of complex real-time transaction processing volumes, and rising security demands at terminal entry points. The wide range of available banking-oriented software packages will drive down the price of individual packages, offsetting increased usage. During the five-year period, the banking/finance CSI market is expected to grow sevenfold to almost \$1.5 billion in annual expenditures.

Over 450 information services and commercial bank vendors have been identified with this market. While no single vendor clearly dominates, several leaders are emerging in certain submarkets, such as NCR, ADP



and EDS in commercial banking; NCR, CDC and EDS in thrifts; and Quotran and ADP in securities and commodities. IBM has been the principal platform supplier to this industry and is engaged in a number of cross-industry projects with specific institutions. Arthur Andersen (now Andersen Consulting) and Coopers & Lybrand lead the Big Eight accounting firms, all of whom have moved aggressively toward CSI opportunities in this market. CSC and Systematics have become more active in the past few years. Commercial banks with increasing CSI involvement include Citibank, First Data Resources (FDR), First Data Management, City National Bank, First Financial, and Fidata. AT&T and Telenet have been prominent in recent CSI projects tied to network integration and management.

## B

### Discrete Manufacturing Industry

This sector covers a wide variety of fabrication or assembly-type manufacturing activities, and care must be taken not to view the sector forecasts as reference to a homogeneous market. Discrete manufacturing is the largest sector of the commercial marketplace, but it is also the most disparate collection of narrowly focused vertical markets, each with its own specific characteristics. Analysts combine specific products into major industry groups, such as aerospace, automotive, metal fabrication, electrical, electronic, telecommunications, textiles, industrial machinery and tools industries, to simplify discussions of trends. This sector excludes consideration of unique automation devices such as robotics and other non-information machinery.

#### 1. Industry Forces

Foreign competition successes in penetrating the U.S. domestic markets, as evidenced by the balance of trade indices, have restricted growth in this sector and in several areas have resulted in the loss of market share. However, there have been significant productivity gains achieved as well. In fact, contrary to popular wisdom, there is no statistical evidence for the widely publicized conversion of the U.S. economy from a manufacturing and industrial base to a services economy.

At present, manufacturing represents the same percentage of the real U.S. GNP, (22%) that it did in 1956. Manufacturing's share of the nominal U.S. GNP however, has dropped from 30% to 18% over the same time period, reflecting a declining share of the current dollar economy. Competition from Pacific Rim companies has become particularly intense over a wide range of products. Some industry reorganization has occurred, but the primary changes have been advances in manufacturing technologies and the widespread adoption of automation.

Manufacturers are implementing flexible manufacturing systems (FMS) to improve the ROI of capital machinery, and providing rapid reconfiguration to meet changing fabrication/assembly demands. Manufacturing



planning and control systems (MPCS) and material resource planning (MRPII) are being employed, along with practices such as "just-in-time" to reduce the costs of carrying inventory. Automation of the shop floor and the efficient utilization of inventory and capacity are viewed as the main productivity goals of the industry.

Application of artificial intelligence, development of expert systems and continued emphasis on computer-integrated manufacturing (CIM) are additional thrusts for productivity through technology, that are largely in the proposal stage and not yet widely implemented.

INPUT believes that the application of these technologies will contribute to cost control, but real advances in productivity will come only by revising the entire manufacturing process rather than by piecemeal automation of (often) inefficient procedures. The latter process has produced islands of automation that provide relatively small improvements. Also, domestic manufacturers need to put stronger emphasis on customer services, an aspect of competition that has not been effectively addressed by foreign producers.

Production experts have postulated the urgency of the need to implement existing technologies, as well as those now in development, for the survival of the majority of discrete manufacturers in the 1990s.

## **2. Impact on Information Systems and Services**

The DP environment in discrete manufacturing seems stable, perhaps even mature. Decreasing hardware costs, better price/performance ratios, and emphasis on purchasing rather than leasing equipment have all served to create a very large base of installed systems, including both hardware and software.

The push to automate manufacturing processes has also created a very large base of mostly incompatible and unconnected process control and automation equipment ranging from materials handling, CAD/CAE, and process controllers to assembly robots and automated guidance vehicles for parts retrieval from stores.

In many of the discrete manufacturing firms, the IS and production organizations function independently of each other, seldom sharing the same data processing platforms. Information systems that process the financial, sales, and administrative aspects usually come under the control of the IS organization. CAD/CAE/CAM/CIM systems tend to be the responsibility of the production/operation departments, often not involving the IS department. However, the newer MRPII and MPCS technologies merge the separate functions, requiring interaction and agreement between the two groups.

The new systems that integrate the sales, purchasing, invoicing, production, and inventory control functions will push IS into interactive, on-line and real-time, or near real-time modes of operation. A substantial number of current financial and administrative systems in this industry do not and have not needed to operate in real time, and are not equipped (hardware and software) to support the needs of flexible manufacturing systems (FMS).

### 3. CSI Potential

This industry has been at the forefront of CSI expenditures for some time, principally from the attention given to computer-integrated manufacturing (CIM) and manufacturing resource planning (MRP). The need to remain competitive, especially with Pacific Rim countries, and the availability of automated systems to improve the efficiency of the manufacturing function encourages firms to adopt CSI, as noted in Exhibit IV-3.

EXHIBIT IV-3

#### KEY FACTORS IN DISCRETE MANUFACTURING INDUSTRY

##### Positive:

- Foreign competition fosters automation
- Continuing capital equipment investment
- Larger sector, extensive project expenditures
- Response needed to inventory controls of distribution

##### Negative:

- IBM dominates hardware component
- Tendency to build rather than buy
- Some negative experiences with CSI
- Industry and CSI experience prerequisite

Expenditures for CSI in 1986 were estimated to be nearly three times larger than the second largest industry, banking/finance. By 1988 these expenditures had slowed to slightly more than twice the banking/finance

industry and about one-and one-half that of state and local government. The growth rate will slow over the forecast period, especially in comparison to the other major industries in the CSI market, as the industry's use of CSI moves further from its embryonic stage toward maturity.

Expenditures may be held back, not by the reluctance to move projects out-of-house but by the lack of new project starts among the largest of firms. According to earlier INPUT estimates, by 1991 over 50% of the 1,500 largest discrete manufacturing firms were expected to initiate projects in a given year and contract some 70% of the expenditures involved. Unless a significant number of today's smaller firms graduate to the ranks of these major firms or the size of the average job increases substantially over the forecast, this market segment could mature more rapidly than forecasted, and miss the 1993 forecasted level. The current volatile economics, both domestic and global, could move the economy into a recession that would discourage capital investment.

The size of this sector and the expected large expenditures are attractive features for CSI (see Exhibit IV-3). Projects tend to be large (e.g., \$20 million) multiyear efforts that fit well with the stable DP environment. Many dollars are also available for smaller, shorter projects, and the use of outside services is growing faster than inside services in this sector. Since client familiarity and acceptance of contractors are essential for CSI, these propensities are also attractive characteristics.

The variety of project types is widespread, from the factory floor to the sales office, indicating a gradual development of traditional areas. Application targets emphasize industry-specialized manufacturing systems, including production/process automation, manufacturing information systems (inventory control, scheduling, material requirements planning, and manufacturing resource planning), CIM, and "factory of the future" developments.

Communications network integration is on the rise and provides entry to CSI vendors who are not engaged in "shop floor" automation. Other project activities include micro/mainframe links, corporate data base development, voice/data integration, office automation, departmental computing, electronic data interchange (EDI), and security.

- Security in the manufacturing sector is an emerging issue as companies interface and integrate systems. Gateways giving access to bills of material, accounts receivable, scheduling data, capacity, and resource planning systems outside the plant are cause for concern.
- Manufacturing applications protocol (MAP) is being considered for CIM applications. While vendors support a MAP standard, users appear to be waiting for MAP to develop before implementing MAP products.



An increasing number of discrete manufacturing firms are faced with meeting new inventory control methods of major assemblers, and both wholesale and retail distributors. The major assemblers of components and complex machinery are instituting MRPs like JIT (just-in-time) delivery requirements to minimize warehousing costs and reduce the prospect of unused parts inventories. More firms will move to integrate FMS with MPCS, shipment scheduling, and front-office ordering and accounting activities.

As in other markets, IBM's hardware dominance and strategy are a factor. They have short-term products in place (CAD/CAE, industrial robots, shop floor microcomputers, etc.) and an apparent long-term strategy of tying these components together in an architecture based on a DBMS on the mainframe. Vendors should be sensitive to the presence of IBM in determining a suitable competitive strategy.

While IS managers frequently cite the absence of project management skills in their staffs, operations executives note the increasing use of systems specialists for CAD/CAE/CAM and automation projects built in-house as workload and financial conditions permit. The tendency of the larger organizations is to build the integrated systems rather than have them built by a CSI vendor. The medium and small-size companies are usually less inclined to carry the needed specialists in their constrained overhead accounts.

Many IS managers in discrete manufacturing report use of CSI contractors and many have negative feedback. They fear the loss of control that seems to be inherent in CSI and show concern for the vendor's lack of industry experience and CSI experience. Vendors may need to initiate early and sustained sales efforts to win the major projects, and demonstrate, through alliances if needed, the prerequisite industry knowledge in particular segments.

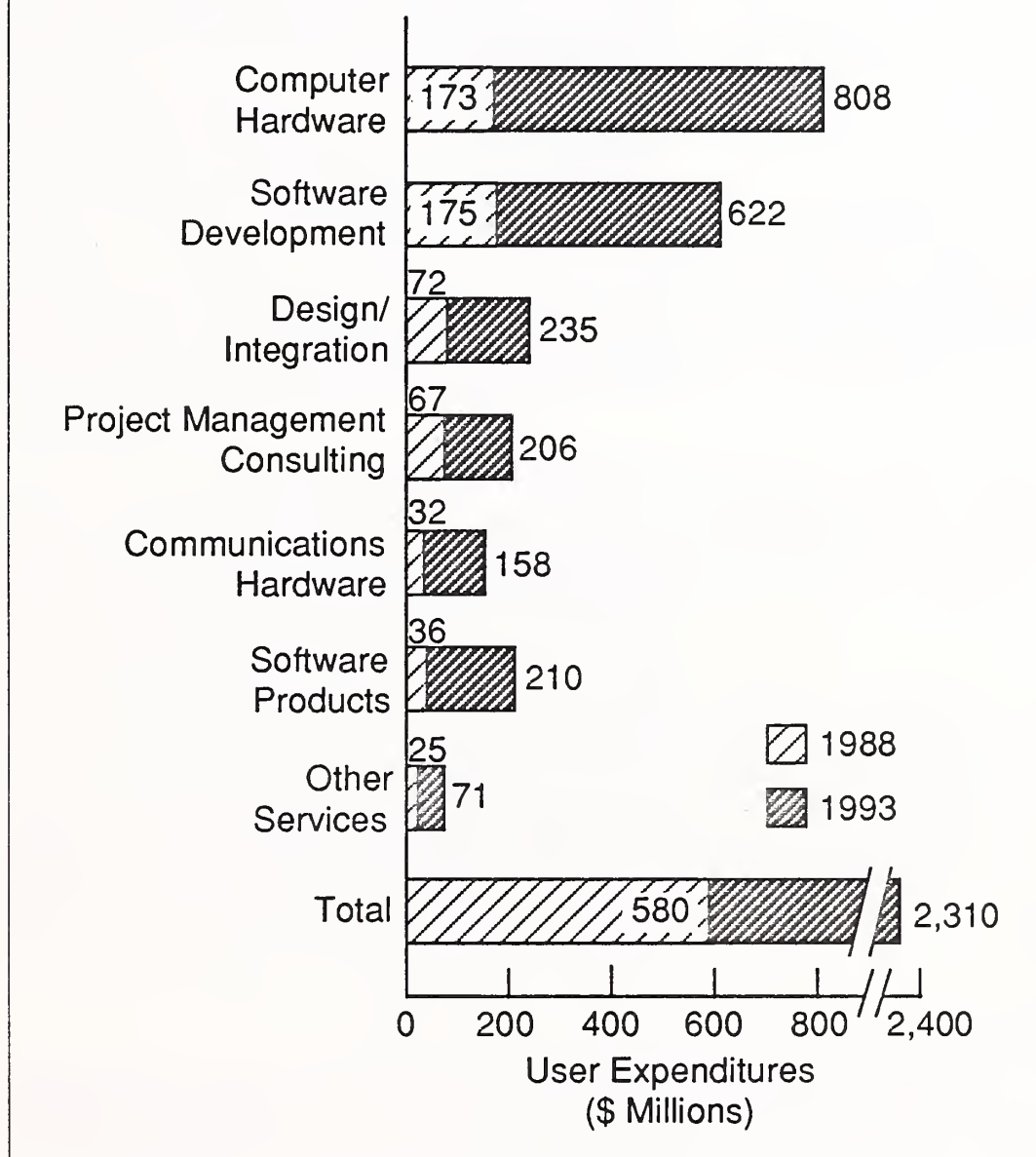
#### **4. CSI Forecast**

The forecast for this sector in Exhibit IV-4 shows a market about one-and one-half times as large as the next largest sector. During the past two years, there has been increasing emphasis on new hardware, which is now expected to grow to \$808 million by 1993. Software development is the second largest requirement, reaching \$622 million by 1993, about a 3% lower CAGR than projected in 1988.



EXHIBIT IV-4

### DISCRETE MANUFACTURING INDUSTRY FORECAST, 1988-1993



The integration of the "islands of automation" found on the shop floor and the interconnection of supplier networks and sales networks with the planning and control processing executed within the information systems department offer broad opportunities for CSI-type projects. A substantial part of this development is heavily dependent on the speed with which the discrete manufacturing industry responds to off-shore competition, the rising cost of labor, and the economic conditions of the next few years.

The different requirements of the market are being addressed by several groups of CSI vendors. The competition in hardware vendors includes IBM, DEC, and Honeywell-Bull. AT&T is currently the leader in networks, while Harnischfeger, Brock Control, Siecor, and Keane Associ-

ates are leading industry specialists. In addition to Arthur Andersen (Andersen Consulting), other leading systems vendors include Systemhouse, CACI, Systems Unlimited, and CTG (SSS). A number of spinoffs, like John Deere & Company's Technical Services Group, are expected to play a role where industry expertise is the most important CSI selection criterion.

This market is so diverse that, even with formidable competition, it remains the single largest pool of opportunities for most systems integrators.

## C

### Insurance Industry

This sector is comprised of life, property, casualty, and health insurance, the reinsurance segment of agents and brokers, and medical claims processing.

#### 1. Industry Forces

Insurance providers who operate in a highly competitive environment are now facing further dilution of market shares by the potential entry of banks, hospitals, and foreign competitors. Financial institutions have made their appearance in the insurance market as competitors with "benefit consultants," "financial planners," and "full-service" business planners.

Other problems face the industry in the form of increased liabilities from tort actions, a growing elderly population with increasing policy levels, the AIDS epidemic, and consumers' concerns about insurance availability and affordability. Recent activities in California and other states are aimed at limiting vehicle insurance premium increases and no-fault insurance settlements.

At the same time, severe losses in the insurance industry during 1984-1985, on the heels of deregulation of the banking/financial industry (in which many of the larger insurance companies participate), forced the same kinds of restructuring of this industry as is occurring in banking/finance.

The increase in the number of agents under a given company umbrella resulting from sales restructuring requires greater control and standardization of procedures. In the process, more automation is required in each agency and more connectivity is needed between each agency and the home office. The competitive environment has led to new insurance products with more complex premium calculations, and to diversification into financial areas and interest sensitive products with fluctuating interest rates that need constant monitoring.

## 2. Impact on Information Systems and Services

As with many other industries, the tight economy and increased competition is leading IS to reduce costs by improving the efficiency of business. Improvement of operations and productivity will most likely be accomplished with a stable or reduced workforce, increasing capacity of existing systems, and automation of insurance functions.

A new role of IS is the effective management of change by anticipating systems needs for new product lines and providing problem management. Systems flexibility is essential to accommodate more products, improve customer services and sales, and permit nationwide systems consolidation across all lines of business. Intra- and intercompany businesses will require a level of compatibility among systems on the same order as the banking/financial industry.

To write better and more competitive policies, insurance companies need more timely information, especially in claims administration. Providing more users with access to mainframe data through enhanced communications capabilities will improve user involvement to offset some of the staff reductions.

There are also requirements for building an infrastructure to support agents in the field, by giving them a sales support systems and by networking within and between offices. Artificial intelligence and expert systems are expected to play an increasingly important role in applications such as underwriting, risk management, investment planning, policy customization, and medical review analysis.

## 3. CSI Potential

IS managers have routinely expanded processing capacity as the demand has risen. In many companies, the current resources will not satisfy the new requirements for speed and access, and need to be replaced, as noted in Exhibit IV-5.

Much like the banking/finance industry, insurance is feeling the competitive pressure and need to manage not only insurance products but also financial products. In fact, recent industry changes have led insurance companies into the same arena, occupied by banks and other financial institutions, providing new products that require additional information support.

Insurance firms are also similar to firms in the banking/finance industry in component purchases for CSI. The IS hardware has been identified; applications software packages are prevalent; and networking needs are clear. CSI projects should focus on integrating systems among product lines (insurance and financial, for example) and between the parent



## EXHIBIT IV-5

**KEY FACTORS IN  
INSURANCE INDUSTRY**

## Positive:

- Replace data processing resources
- New products (insurance and financial) require support
- Need for on-line policyholder/client information
- Integrated network requirements
- Need for on-line multifunction systems

## Negative:

- Cost controls limit new starts
- Ongoing industry restructuring
- Industry-specific knowledge/experience
- Self-sufficiency mentality

organization and the vast structure of the sales organizations through integrated networks.

Corporate data bases might include subsystems for sales/marketing (product management, client file, agency support systems, new insurance/claims, applications, etc.), for management (accounting, accounts payable, insurance, administration, office applications control system), and for policy management (loss system, rating/policy issuance, casualty rating, etc.).

The opportunity for CSI vendors appears to be more in the development of new systems rather than upgrades and expansions of current ones. These new systems are important to the business, but IS is frequently unable to develop them since most personnel are assigned to maintenance resulting in a shortage of capabilities in the more sophisticated technologies required in integrated systems. IS managers in this industry have identified the importance of project management skills in design and implementation of networked systems and the frequent lack of these skills within the in-house staff.



The most significant constraint of CSI growth is the limit placed on new starts by the cost controls of a highly competitive industry. Projects might be performed in phases to minimize investment risks. The ongoing industry restructuring may also delay initiation of desired integration activities, while management sorts out the features needed to meet new business objectives.

As in every vertical market, there is a strong preference for demonstrated industry-specific knowledge. This requirement tends to favor spin-offs and CSI vendors with extensive insurance and financial systems experience.

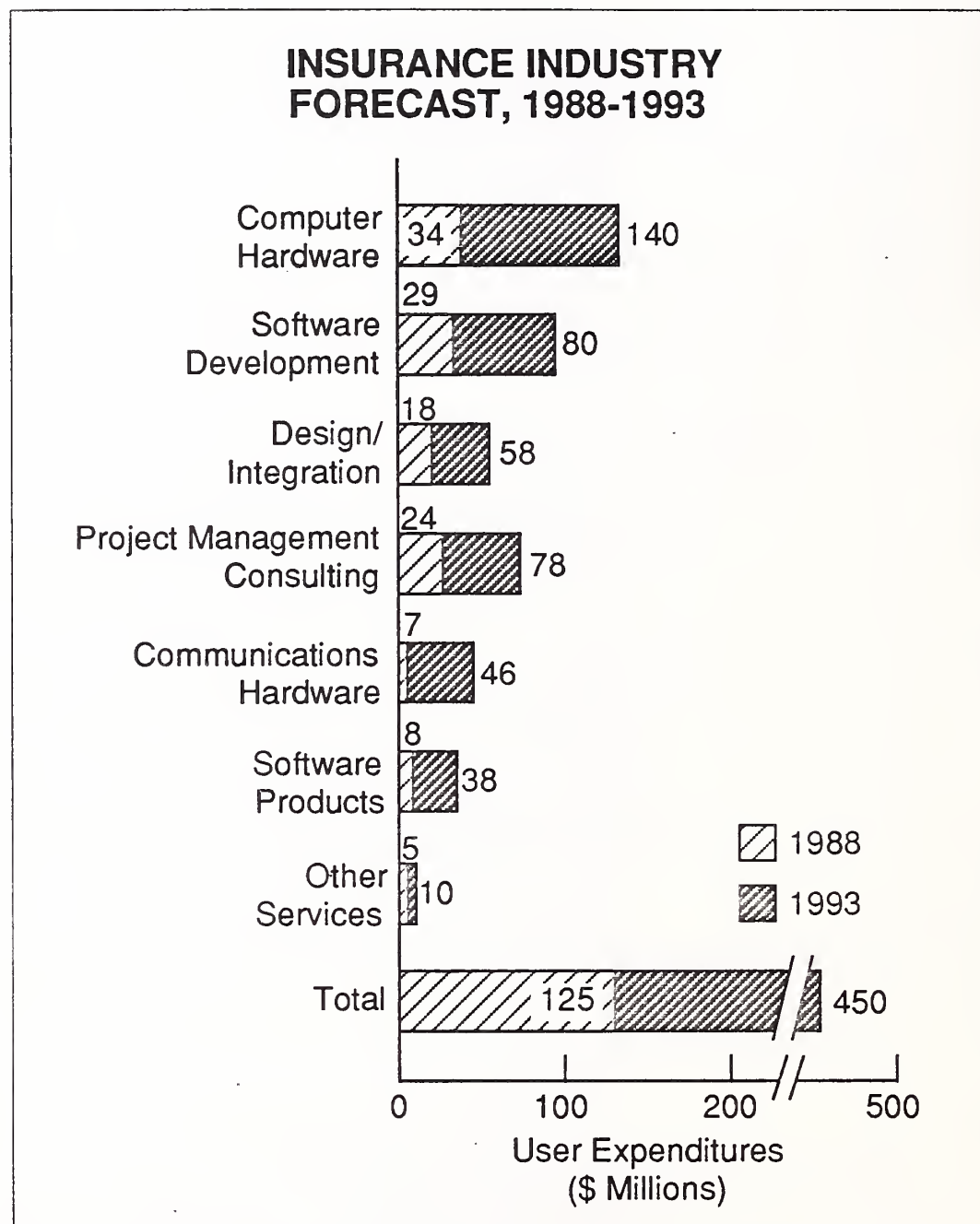
The earlier expectation of above average growth did not materialize since the 1986 forecast, when the insurance industry was identified as having the potential for the fourth fastest growth rate. It is now seen as seventh in terms of growth and potential expenditures by 1993.

This sector has had a number of CSI projects that have run into major problems. In 1982 EDS began automation of office operations for All-state Insurance for \$8 million; the project was completed in 1987 by Peat Marwick and Mitchell for \$100 million. In 1983, EDS undertook a project to coordinate all information services for Blue Cross/Blue Shield United of Wisconsin for \$200,000, but after 18 months it was unsuccessful. In 1985 an unnamed Big Eight firm undertook a system to perform risk analysis of major policies for \$500,000; it has cost \$2 million to date and won't be ready until 1990.

#### 4. CSI Forecast

The forecast for this sector noted in Exhibit IV-6 shows a 29% CAGR from a base of \$125 million in 1988 to \$450 million of annual expenditures in 1993. This represents a significant reduction from the 40% CAGR forecasted in 1986, resulting from the restructuring of the industry and indecision on new resource investment. The largest component by 1993 will be hardware with \$140 million for system replacement. The very customized nature of the requirements are reflected in the low forecast for standard software products, and software development expenditures at three times the product rate. The combined professional services will be the second largest sector expenditure.

EXHIBIT IV-6



There are only a few CSI vendors with experience in this sector. EDS and CSC have extensive claims processing and policy systems experience. Arthur Andersen and Coopers & Lybrand have implemented systems and Equifax has provided both services and systems in specialized areas. Penetration of this sector by CSI vendors is viewed as difficult without industry experience or an alliance with one of the above vendors.

## D

### Medical Industry

This sector includes physicians, dentists, hospitals, medical and dental laboratories, nursing homes, outpatient care facilities, and allied services. It excludes health insurance and medical claims processing covered in the insurance industry sector.

## 1. Industry Forces

In 1984, for the first time in two decades, the rate of growth in this sector fell below double digits, and the trend has continued.

The increase in expenditures from 1987 to 1988 rose about 9% each for health care, hospital care, physicians, and nursing homes. Competition is already a factor with the emergence of health maintenance organizations (HMOs), preferred provider organizations (PPOs), and investor-owned hospitals and group practices. Hospital care is the dominant category of costs. To contain these costs, occupancy rates continue to fall and the length of stay has been shortened by shifting to outpatient care and home health agencies (HHA).

The federal government, Blue Cross/Blue Shield insurance companies, and even large employers are pressuring health care providers (physicians/dentists), hospitals, laboratories, nursing homes, outpatient care facilities) to reduce costs, which are rising faster than the consumer price index (CPI).

The government has established prospective payment systems (PPS) in diagnostic-related groups (DRGs) and is shifting reimbursements from a cost basis to a DRG-basis. Health care coverers and large employers, concerned that costs are rising faster than revenues, are also seeking reductions. As a result, providers are forced to compete for a declining number of patients and medical reimbursement is seeking solutions with lower costs.

## 2. Impact on Information Systems and Services

DRG-based reimbursements demand current, on-line handling of patient information on a cost rather than expenditure basis. Separate systems for financial operations, patient care, nursing management, and laboratory management are being integrated as one way to reduce data-entry redundancy, error rates that accompany constant re-entry of the same information, and the wasted manpower that occurs with both.

The Catastrophic Illness Act of 1988 revised the Federal Medicine Program of Title XVIII of the Social Security Act. The increase in outpatient care and home health care creates greater demand for clinical and financial information systems. Administration of the new prescription drug program and increasingly detailed claims processing provides additional opportunities for information system vendors.

## 3. CSI Potential

Constraints in federal support health care, particularly Medicaid, will continue, and the efficiency in such diverse areas as reimbursement



systems, medical records, patient history, pharmacology, and bed occupancy will fuel CSI activity as seen in Exhibit IV-7.

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**EXHIBIT IV-7**

### **KEY FACTORS IN MEDICAL INDUSTRY**

#### **Positive:**

- Pressure to constrain medical services costs
- Defensive medicine requirement for more data
- Hardware operating at capacity
- High use of outside contractors

#### **Negative:**

- Turnkey systems vendors very active
- Industry experience and acceptance required
- Limited number of large clients
- "Bottom-line" financial limitations
- Fragmented marketplace

Defensive medicine is being practiced by physicians and hospitals to reduce the risks of unfavorable malpractice judgements. This includes duplicate tests, extensive diagnostic procedures, use of consultants, and extensive documentation creation and retention. The information systems associated with these activities will require integration of the current standalone information and data systems.

Intrahospital communications networks will be important with some networks extending to other community providers such as physicians and laboratories. Equally important will be large data bases that consolidate patient information and insurance claims tracking. Major projects will involve integrating applications within the same physical location.

During the recent cost-containment efforts, there has not been any substantial increase in computer capacity. Despite the need for continued cost control, new capacity will be required, including upgrade or outright replacement of many of the large institutional information systems.



In the absence of many of the skills required during the course of major projects (planning and project management in particular), use of outside information services has been high. Vendors are required to have industry experience and, in many cases, knowledge of, and experience with, the specific medical establishment.

The turnkey systems vendors have done well in this market and will likely continue to succeed. This is not a market where entry is particularly easy, but local VARs have been effective in gaining acceptance from administrative and medical staffs.

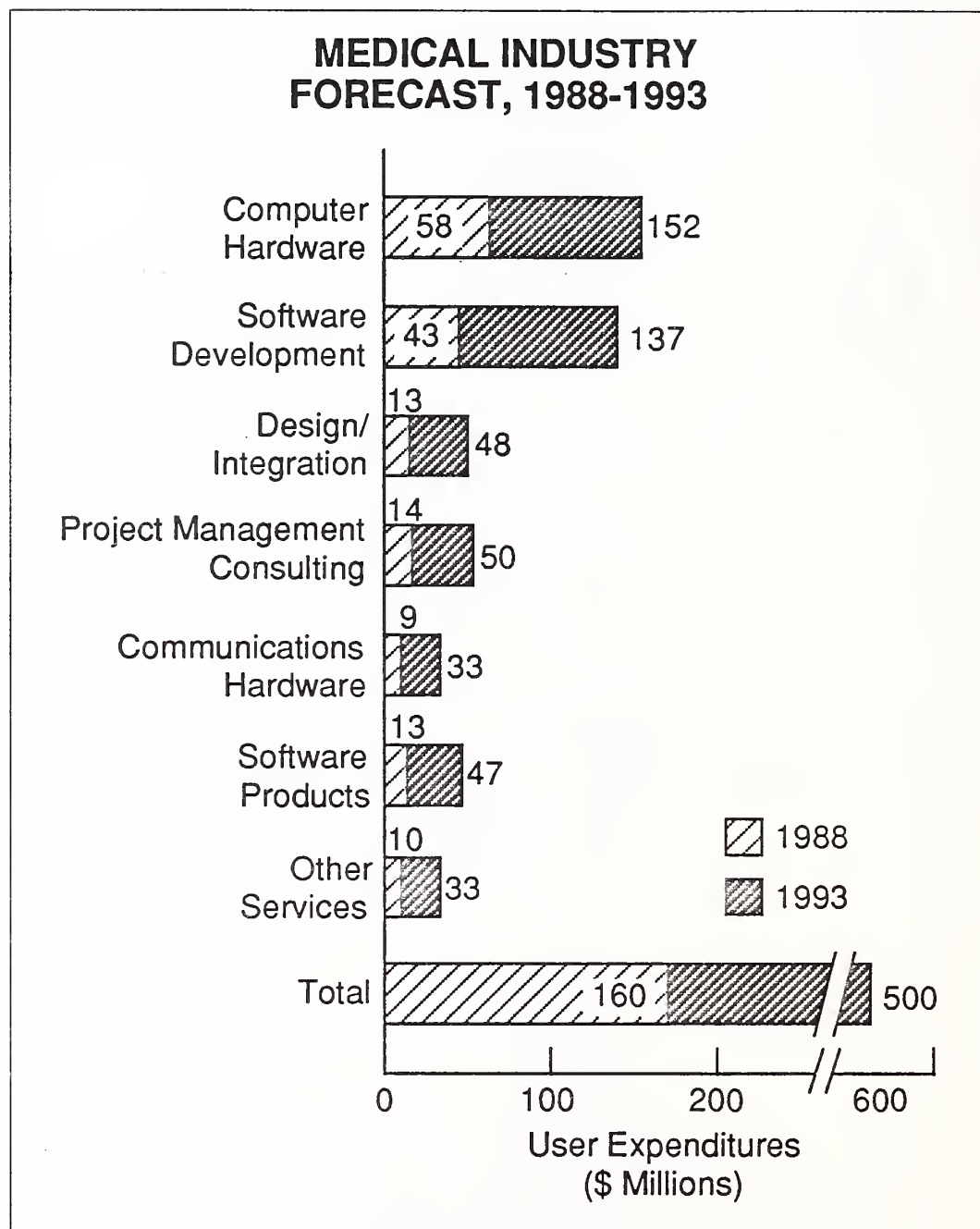
The size of the medical CSI industry is constrained by the limited number of establishments large enough to support the size of effort typical of systems integration projects. In INPUT's forecast, less than 300 firms are sufficiently large enough, including major hospitals with over 300 beds, multiple service clinics, and multisite HMOs and PPOs. Of those, only 25% to 30% are expected to undertake major CSI projects, either internally or externally.

Medical institutions that have begun or recently completed CSI projects highlighted their requirement that the proposed solution had to demonstrate a bottom-line contribution potential and a cost envelope that met the institution's outlay expectations. CSI vendors will need to overcome the financial limitations with creative project financing and by building a strong case for the cost savings that will result from planned projects.

#### 4. CSI Forecast

The forecast for this sector shows in Exhibit IV-8 the improved potential for CSI that INPUT now expects, reaching an annual expenditure of \$500 million by 1993 at a CAGR of 26% from a base of \$160 million in 1988. Earlier, the data for the 1986 forecast suggested a much lower base of only \$22 million, but with a CAGR of 44%. The emphasis will continue to be placed on newer computer hardware, with custom software development following closely behind. Communications prospects appear to be higher now, with new network requirements being identified.

EXHIBIT IV-8



More than 160 vendors sell information systems and services to the medical sector. Leaders in hospital MIS include HBO, SMS, CSC, SAIC, and Ernst & Whinney. Leaders in patient care are IBM, EDS, SMS, McDonnell-Douglas Health Systems, and CyCare. There are also a relatively small number of software firms that have successfully developed packages adapted to the medical environment. Alliances with these vendors could be beneficial to CSI contractors.

**E****Process  
Manufacturing  
Industry**

This sector is a combination of medium and large corporations active in oil and gas, mining, tobacco, chemicals, paper and wood products, food processing, rubber, primary metals, and plastics.

**1. Industry Forces**

All industries except for the tobacco industry have experienced a downturn in raw material prices. The tobacco industry and others have been impacted by reduced demand, and all have been affected by competition and environmental pressures. The chemical, wood products, and primary metals industries are also facing price pressures from off-shore competition.

The process manufacturing sector has been driven in recent years more by the economy than by manufacturing technologies. Major efforts are focused on reducing costs, improving operating efficiencies, increasing capacity utilization, and reducing capital commitment risks, while maintaining a competitive posture through automation. The solution to cost problems of some organizations has been mergers to gain economies of scale.

**2. Impact on Information Systems and Services**

Financial, technical, and personnel factors have all forced moderation of growth in IS. Automation of manufacturing processes, as in discrete manufacturing, is a key initiative. Unlike discrete manufacturers, however, process manufacturers also have extensive needs for communications network integration that ties the sources of raw material to the processor and the processor to the seller.

This sector continues to offer opportunities for process control, inventory control, and shipping control systems with heavy engineering and instrumentation content. Processes to be automated tend to be simple in overall concept but complex in implementation detail. Quality and environmental control and inspection systems with associated materials handling have become focal points for systems integration projects.

Automation integration efforts to date have been almost entirely focused on production and are considered embedded systems that are not part of IS. Information systems and software projects have concentrated on MRP/MRP II, accounting, inventory control, and statistics applications with little integration involved. CIM applies equally as well to process manufacturing as to discrete manufacturing, but has seen more discussion than application, except by Comserv, and even then only for MRP II.



### 3. CSI Potential

Unlike discrete manufacturing, process manufacturing firms have been much slower to adopt CSI. Expenditures in 1988 are estimated at approximately \$100 million and the growth rate at a below-average 25%. The smaller number of firms and fewer major project starts sets these two industries apart, as seen in Exhibit IV-9.

EXHIBIT IV-9

#### KEY FACTORS IN PROCESS MANUFACTURING INDUSTRY

Positive:

- Competitive need to meet market demands
- Need to improve operating efficiencies
- Network design/integration requirements
- Need support for marketing and strategic planning

Negative:

- Few large establishments
- Reluctance to contract for services
- Process concentrated in operations

Like discrete manufacturing, this industry has a competitive need to meet widely varying market demands. Participants need to unify and coordinate diverse data structures, process systems, and application developments, to support marketing and strategic management. A number of recent projects have focused on network design and integration to aid in the unification process, and are expected to expand to multiplant operations.

The need to improve operating efficiencies will concentrate on automation, MRP/MRP II, and production control systems that can provide for higher capacity utilization with lower operating costs. These improvements are expected to contribute to reduction of capital investment risks.

IS managers see shortcomings in in-house project management and network design, but do not, in general, seem particularly inclined to pay an integrator for these capabilities. Interestingly, training and transition



management is also highly valued in projects, but internal staff appear to be inadequately prepared to provide it. In this market, support may be a key benefit to be offered by CSI contractors.

From a negative CSI perspective, there are few large establishments capable of supporting significant integration projects. Since the 1986 forecast, the number of firms has dropped to 130, but revenues have improved by at least ten percent.

#### **4. CSI Forecast**

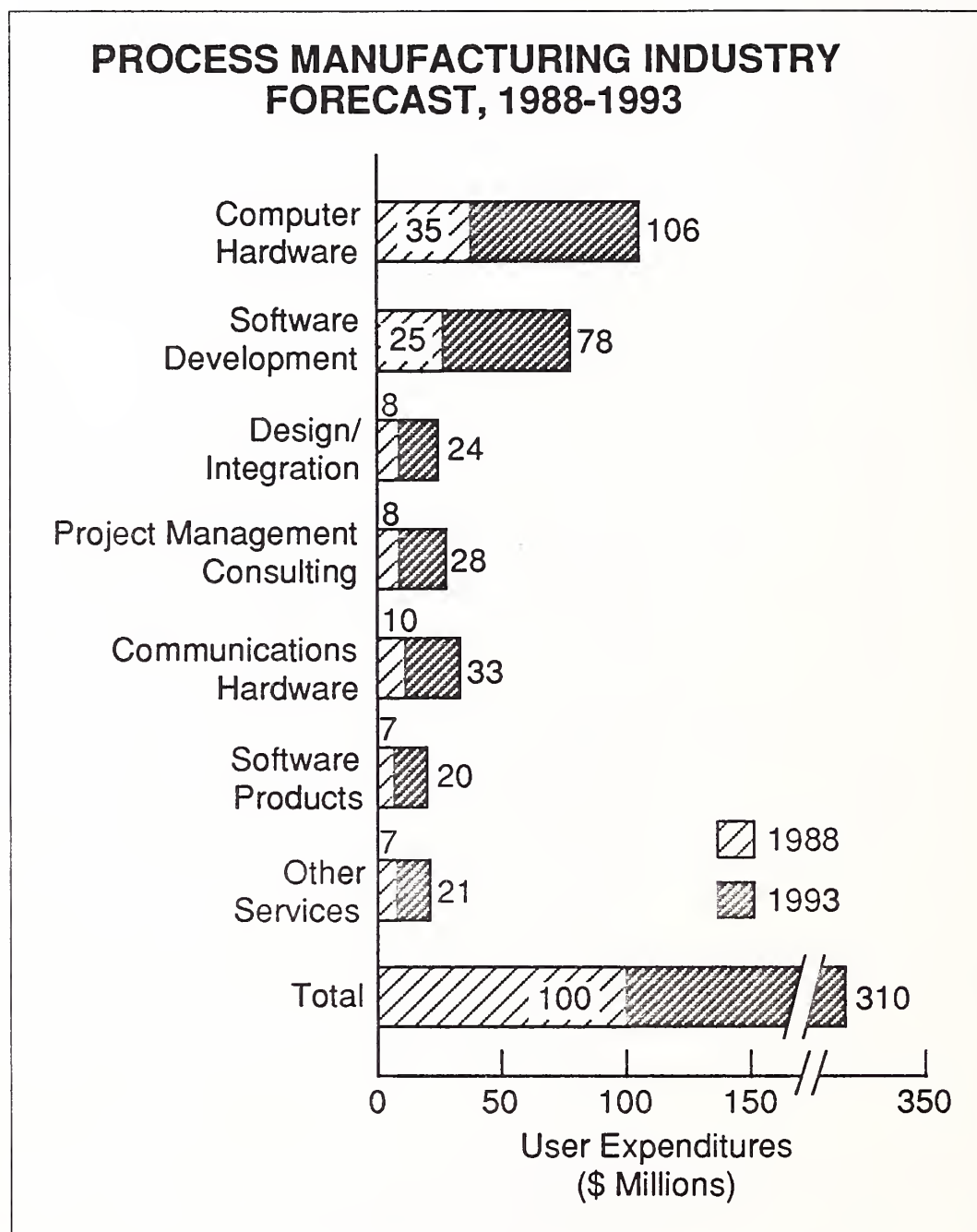
The 1988 expenditures in this sector, as shown in Exhibit IV-10, are less than one-fifth of the expenditures in the discrete manufacturing sector for all of the reasons given. By 1993, yearly CSI expenditures are expected to reach \$310 million, up from a base of \$100 million in 1988. Hardware appears to edge out software development as the most important component, similar to discrete manufacturing, and just as it did in the 1986 forecast.

The professional services components of project management, design, and integration appear smaller in relation to software development than in most of the other vertical markets because the operations organizations employ more technical staff, and the ratio of information systems to production systems is smaller. Other services include instrumentation and process control specialists needed in CSI projects to meet technical criteria.

There are no principal competitors, but a number of potential partners for CSI exist in the group of heavy machinery and automation vendors in each vertical segment.

CSI contracts in this sector are in evidence, for example Arthur Andersen for food products, but are more difficult to come by and smaller in size. CTG (SSS), EDS, Oil Systems, Systemhouse, and Coopers & Lybrand' also have key programs in this sector. Contel has provided network integration for several firms.

EXHIBIT IV-10

**F****Retail Distribution Industry**

The retail distribution sector includes single establishments and chains in apparel, food, appliances, drugs, hardware, etc.

**1. Industry Forces**

The steadily shrinking margins and growing competition in this sector have encouraged the development of very high volume, very low margin units that are constantly seeking ways of drawing customers by offering unique or convenience-oriented services. Competition has increased at a faster pace than the rate of market expansion. This has led retailers to become involved in electronic funds transfer systems, check verification systems, and POS networks.

There are only 800 large retailers, of the more than one million companies, that are the principal targets for CSI in the immediate future. The emphasis of these firms will be on improving and integrating external and internal communications.

Externally, communications with customers have become very important. Better communications links facilitate the flow between customers, outlets, retailers, and wholesalers. For example, WalMart and Kmart use satellite dishes to expedite the flow of critical sales data to central computers for stock-control and pricing decisions. The use of information systems for credit checking and POS data collection ensures the steady flow of funds while monitoring inventory. Back-office use of computer-to-computer order processing increases the speed of locating and delivering merchandise.

Internally, the primary use of automation thus far has been applications for closely monitoring finances, supporting financial decisions, and analyzing profit margins, but not for providing strategic management decision information where and when it is needed.

While management is concerned with the increasing communications costs required to support a broader network, they believe that the use of technology is the only way to simultaneously control costs, track customer buying patterns, manage inventory, and match merchandise to demographic buyer interests.

## **2. Impact on Information Systems and Services**

The mission of IS, given the broad diversity of products handled by each outlet, is to provide systems that control logistics associated with warehouse and shelf inventory, pricing and obsolescence of goods, etc., while also handling the logistics of credit/bad check verification, bad credit losses, cash handling, and funds consolidation and transfer.

IS is also expected to develop customer-oriented services for faster and simpler order entry, transaction processing, in-store processing (distributed processing), and the use of such technologies as EDI to reduce paperwork.

Provision by IS of real-time information for improved decisions by management means improved marketing/sales data, sales demand forecasting by demographic areas, vendor performance ratings, telemarketing systems, and inventory deployment models.

Increased integration of data processing and communications in the distribution industry appears to be essential to provide on-line connectivity of all operating elements, distributed processing to all locations, and end-user support throughout the organization.



### 3. CSI Potential

The shift to financial controls and demographic merchandising requires drastic redesign of outdated pricing and distribution applications. Integration of newer technologies, including simulation, expert systems, EDI, and decision support systems, is viewed as essential to maintaining a competitive position as seen in Exhibit IV-11.

EXHIBIT IV-11

#### KEY FACTORS IN RETAIL DISTRIBUTION INDUSTRY

##### Positive:

- Shift to financial controls
- Increasing use of POS and optical technology
- Strong interest in customer service
- Network design and project management needed

##### Negative:

- Infrequent user of outside services
- Smaller than average project expenditures
- Prevalence of small firms
- Low profit margins

POS technology provides information that can be applied to inventory turnover, demographically-based demand, advertising effectiveness, sales efficiency, and space utilization analyses that are rapidly replacing merchandising intuition as the basis for distribution decisions. Optical technology applications range from bar-code label readers to support POS and warehouse transactions to color-sample comparisons and broadband data communications for more error-free capture and movement of data.

Retail establishments have rediscovered the critical importance of customer service to insure repeat sales. Among the tools being employed are rapid credit checks and multiple payment methods, early warehouse response to local out-of-stock requests, telemarketing services, and accurate tracking of shipments to clients. All of these depend on rapid



and accurate transfer of information that may exceed current systems capabilities.

From a functional point of view, retail organizations are seeking outside help for communications network integration, voice/data integration, micro/mainframe connectivity, and office information systems integration.

IS managers' analysis of their own in-house capabilities and constraints suggests that they feel the current staff is not available and/or does not have the technical capabilities required for these types of projects. Specific skills they require relate particularly to network design and complex project management.

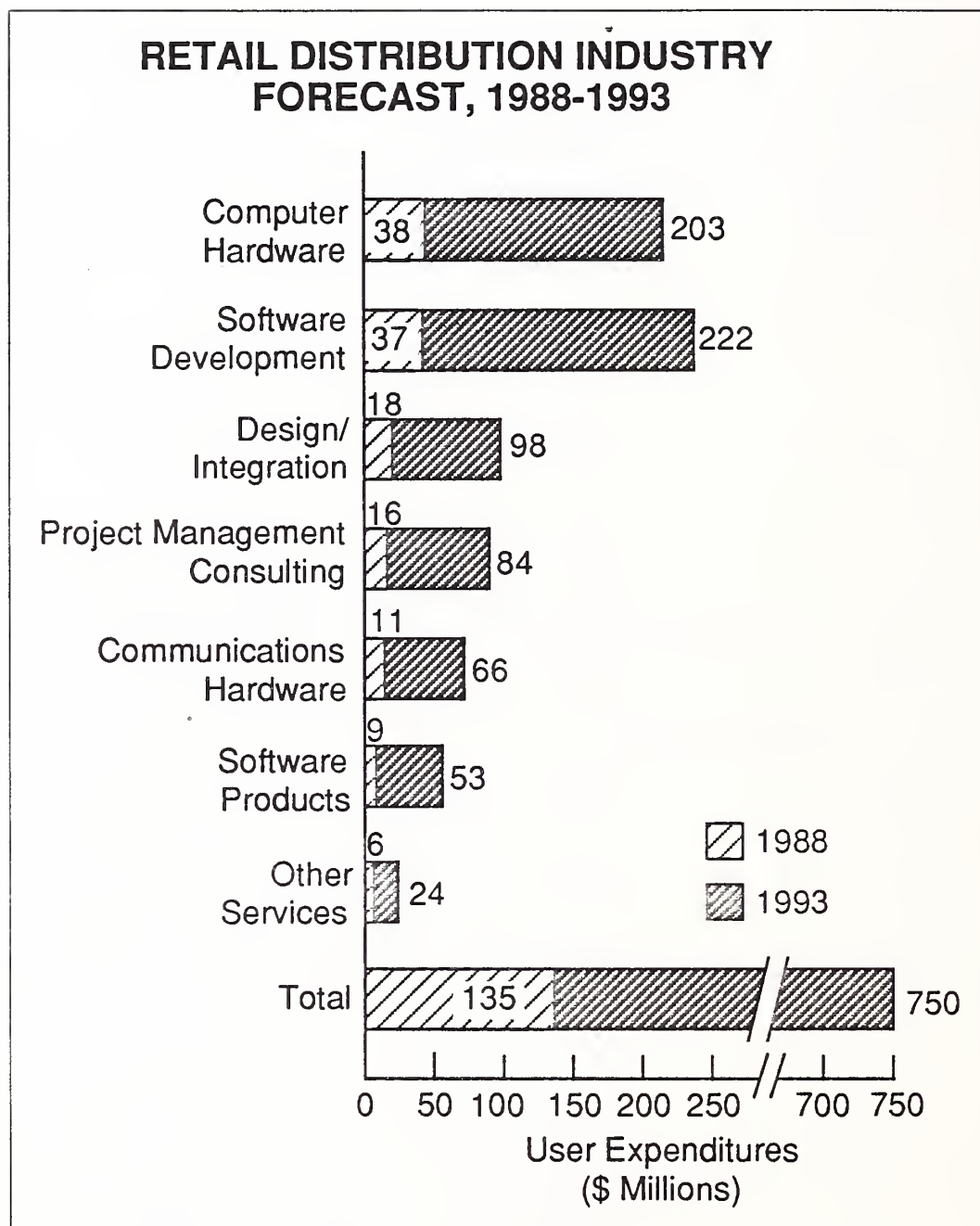
Economic conditions of small margins, low investment capital availability, increasing labor costs, and rising facility costs have discouraged frequent use of outside services, except when considered absolutely essential. Most information product or service acquisitions are piecemeal, building on existing resources.

While the number of firms in the distribution industry that could support CSI is large, major project expenditures have been limited. The larger number of medium-sized firms have traditionally not been driven by the need for automated solutions as much as by merchandising skill. But this is changing by necessity, as large wholesalers and retailers find their margins shrinking even further in a more competitive environment.

#### **4. CSI Forecast**

The forecast for this market shown in Exhibit IV-12 indicates strong growth in CSI expenditures (CAGR 41%) as the impact of automation as a competitive weapon is felt from the display floor to the loading dock. By 1993, retail distribution expenditures for CSI are expected to grow to \$750 million annually from a 1988 base of \$135 million. Sales of software products, meanwhile, are expected to be subdued.

EXHIBIT IV-12



This forecast is different from the 1986 version in the separation of the retail from the wholesale distribution market. Of the two, the retail CSI market will grow nearly three times faster. Software development activities should be in particular demand in CSI projects because applications software needs cannot be met by off-the-shelf packages in such a diverse market. Application areas are expected to extend from sales/marketing (sales demand/budgeting/forecasting, scheduling, sales tracking, tele-marketing, order/entry processing, and credit checking) to management (payroll, retail accounting, human resources, accounts receivable, purchase order systems, and warehouse control).

While the need is apparent, use of outside services has not been frequently made in this industry sector. Broadly speaking, IBM and NCR dominate the hardware segment. Arthur Young, CACI, EDS, and Sys-

temhouse have been identified with recent distribution projects and are expected to leverage these experiences. AT&T and Illinois Bell have provided some of the advanced network management projects. At least one recent spinoff, Strategic Information Services, from Pennzoil, has been involved in retail distribution systems for petroleum products. Moderate expenditures and strong growth are expected, but most projects will be relatively small compared to other industries.

## G

### Services Industry

This sector is composed of professional services (e.g., accounting, legal, engineering), personal services (e.g., garment cleaning, reproduction, dwelling services), and business services (consulting, public relations, telemarketing).

#### 1. Industry Forces

This sector is characterized by a very large number of small businesses, professional practices, and other groups that do not represent a target for CSI, but are suitable for turnkey vendors and other VARs. Only a few vertical submarkets appear to be worth structuring a specific marketing effort, for smaller CSI vendors, but the entire market will be opportunistic.

Automation of functions has not played a significant role to date in the development of this industry. Recent interest in information accumulation, handling, and disposition has led to new starts in such areas as information networks and textual and statistical data bases, for service and trade associations, and the general information industry. These markets have experienced notable growth recently as their services have become more attractive and cost effective to both small and large organizations that need the support but prefer not invest in internal organizations.

#### 2. Impact on Information Systems and Services

Since this sector is characterized by small business, professional practices, and partnerships, the IS function is significant only in the largest firms and associations. Accounting, legal, and engineering seem the most susceptible to CSI, but on a smaller scale. Because many have either leased processing services or employ PC-based resources, they are ready to invest in new technologies to provide enhanced services in expanding markets.

#### 3. CSI Potential

Although not sharply focused, there are new demands for networks and on-line data bases or data base support facilities, as noted in Exhibit IV-13. A number of service organizations are large enough with increas-



ing needs to support a limited number of CSI projects. The service organizations include conference and exhibit corporations, national and international real estate leasing and sales organizations, and national professional, trade and technical associations. Service sectors are organizing support systems which are jointly owned or fee-based for member groups.

## EXHIBIT IV-13

**KEY FACTORS IN SERVICES INDUSTRY****Positive:**

- New demands for networks and data bases
- Key service sectors are organizing support systems
- Markets creating new system demands

**Negative:**

- Few large enterprises
- Minimal use of automation
- Few large-scale opportunities
- In-house control of large client systems

Even the largest segments present few large-scale opportunities, so no single area is worth a dedicated marketing thrust. Further, in some sectors (i.e., "Big 8" accounting firms, large engineering companies) the capabilities exist for inhouse management of major projects, lessening the size of the CSI market for this sector further. New technologies are gaining wider acceptance, but there appears to be minimal use of, or opportunities for, automation.

**4. CSI Forecast**

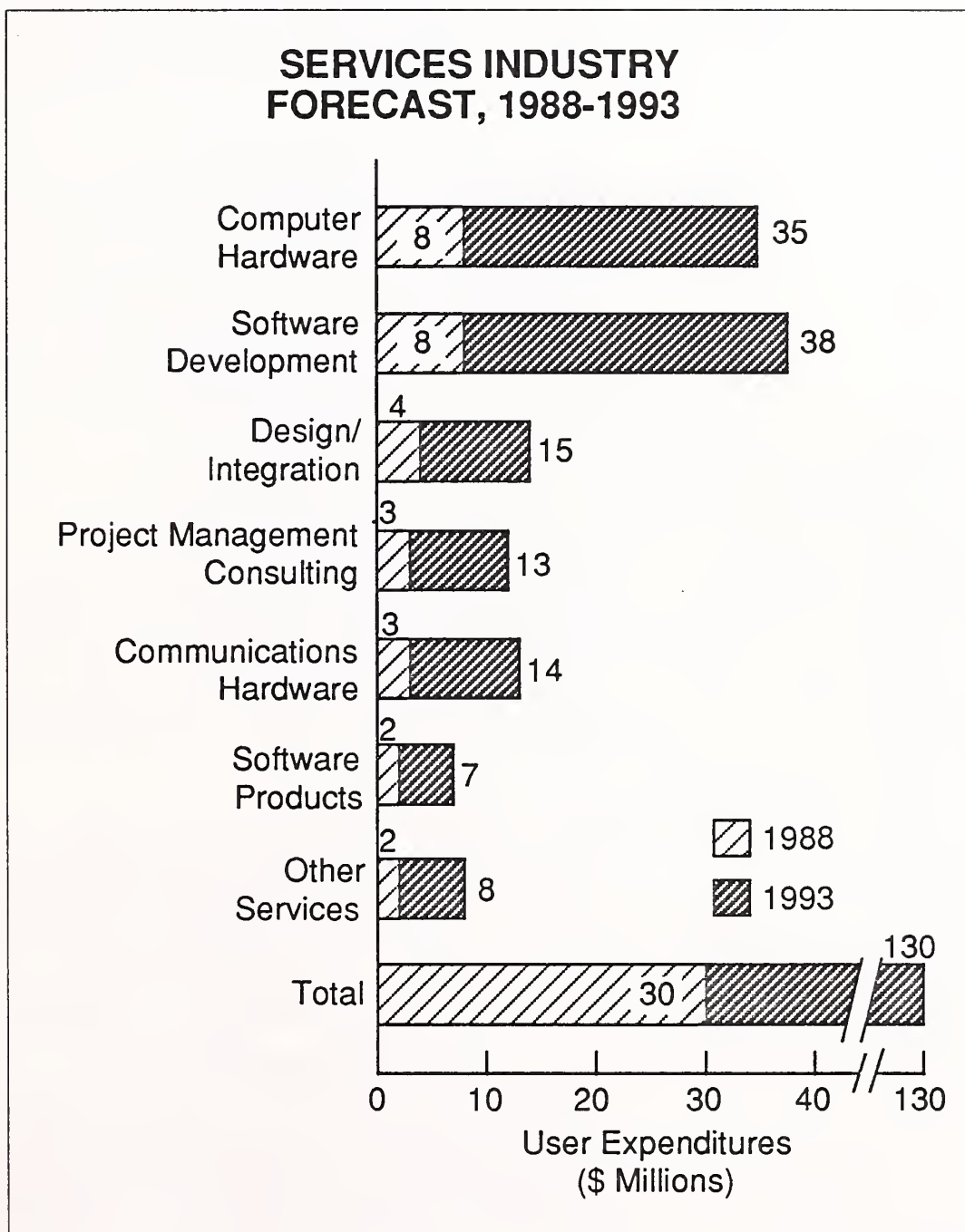
The forecast for this sector shows in Exhibit IV-14 continued limited CSI potential with only \$130 million in yearly CSI expenditures by 1993 from a small base of \$30 million in 1988. Both the 1988 and 1993 forecast values are double those projected for the 1986-1991 period earlier, in recognition of the continuing mergers of small service organizations and a surprisingly strong demand for their services. These repre-



sent prospects for specialized software development and new hardware, most likely for the new series of workstations with the power of mainframes for desk-top publishing and graphics. The communications hardware component is comparatively larger than other sectors, reflecting strong network interest.

Competitors and possible CSI partners include Reynolds and Reynolds, Data Central, and West Publishing. Several RBOCs have shown interest in expanding network systems to include new specialized information systems.

EXHIBIT IV-14



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**H****State and Local Government**

This sector includes city, county, regional/district, and state government bodies, particularly those involved with public safety, highways, welfare, education, health and social services, and sanitation.

**1. Industry Forces**

Much like the federal government, state and local governments have come under greater financial pressures as requirements for services increase without corresponding improvements in the tax revenue base. The passage of the Gramm-Rudman-Hollings Deficit Control Act had an immediate and continuing impact on federal support of state governments, but current large support contracts have not been cancelled. CSC, IBM, Arthur Andersen, and EDS look to this sector to generate significant revenue opportunities in the next five years.

If past contracting patterns continue, 45% of state and local government expenditures will come from state governments, 30% from cities, 14% from counties, and only 11% from districts and other authorities. Proposals to move more data processing activities in-house have been blocked by staff retention problems and demand growth that continues to exceed available in-house resource capacity. Use of contract services is seen as more economical and politically more desirable, since it avoids increasing government employment levels.

**2. Impact on Information Systems and Services**

The mission of information systems departments in state and local governments has broadened considerably in recent years. Despite budget limitations, the demand for new services, especially on-line systems, has increased for health and social services, tax and fee collection for licenses, court and criminal justice needs, real estate construction/inspection/assessment data, voter/vehicle and business registration, and public safety and civil aid services.

Most of the older government information systems that operated in the batch processing mode have been replaced by interactive on-line service systems. Replacement or upgrade of hardware and software to meet new requirements have been met by standalone workstation or PC-based and turnkey systems, or by contracted processing services. The variety of solutions has not been amenable to integration or shared data bases.

Connectivity between systems has been resolved at state and large metropolitan centers by reliance on commercial networks from the common carriers. Network implementation between office information systems, the larger data processing systems, and contracted services still requires attention in the medium-sized facilities of counties and districts.

However, cutbacks in staff and the inability of government agencies to remain competitive with private industry in salaries for technical personnel has resulted in a shortfall of qualified in-house staff. This creates a natural opportunity for CSI vendors.

### 3. CSI Potential

The need for integrated systems in this government sector is large and some projects to provide for integration of new resources that could be contracted will likely be very large, making this sector attractive, as noted in Exhibit IV-15. The principal customers will be the industrial and coastal states, large metropolitan centers, and a few large counties in this sector that have the financial resources and demand for improved services.

EXHIBIT IV-15

#### KEY FACTORS IN STATE AND LOCAL GOVERNMENT MARKET

##### Positive:

- Continued demand for information services
- Move toward in-house data processing
- Shortfall of qualified in-house staff
- Increasing CSI opportunities with FM options
- Increasing network and resource sharing demands

##### Negative:

- Dispersed market (82,000 government units)
- Emphasis on local vendors
- Impact of federal budget deficit controls
- Interest in small turnkey solutions (VARs)

If the legislative emphasis toward increased use of in-house data process prevails, the shortfall of qualified project managers and technology specialists on in-house staffs would substantially increase CSI prospects. Executives and governing bodies want integrated systems that can share data, provide planning services and information on public issues, assure



the integrity and security of personal data, reduce current maintenance backlogs, and offer more timely budget and financial data. Software tools that support analyses of alternative solutions to public sector problems are desired by regional and district officials.

One interesting window of opportunity appears to be facilities management contracts. It is not uncommon for vendors to extend CSI projects into FM contracts on completion. Conversely, a number of CSI projects grew out of FM contracts for operating existing but older systems, particularly at the larger county government level. By the end of the project, the contractor is well known to the client and has a better understanding of the system than anyone, including the client.

Unfortunately, this market is large (82,000 government units) and geographically dispersed, presenting a significant problem for marketing and sales activities. The wide separation of opportunities also appears to foster greater dependence on local vendors who may lack adequate support staffs.

Despite the urgency of the need, many information firms find it difficult to compete because the roles and influence of officials, IS management, and advisory groups are not always clear, and some decisions seem arbitrary or political. This latter aspect indicates the reason that locally based VARs have been more successful in the smaller counties and communities in furnishing turnkey system solutions.

The impact of federal budget deficit controls has been felt down the line to counties and districts previously supported by the local presence of federal facilities, both military and civil. Proposed closure of military installations and reduction of concentrated civil agency facilities are expected to severely reduce near-term CSI prospects.

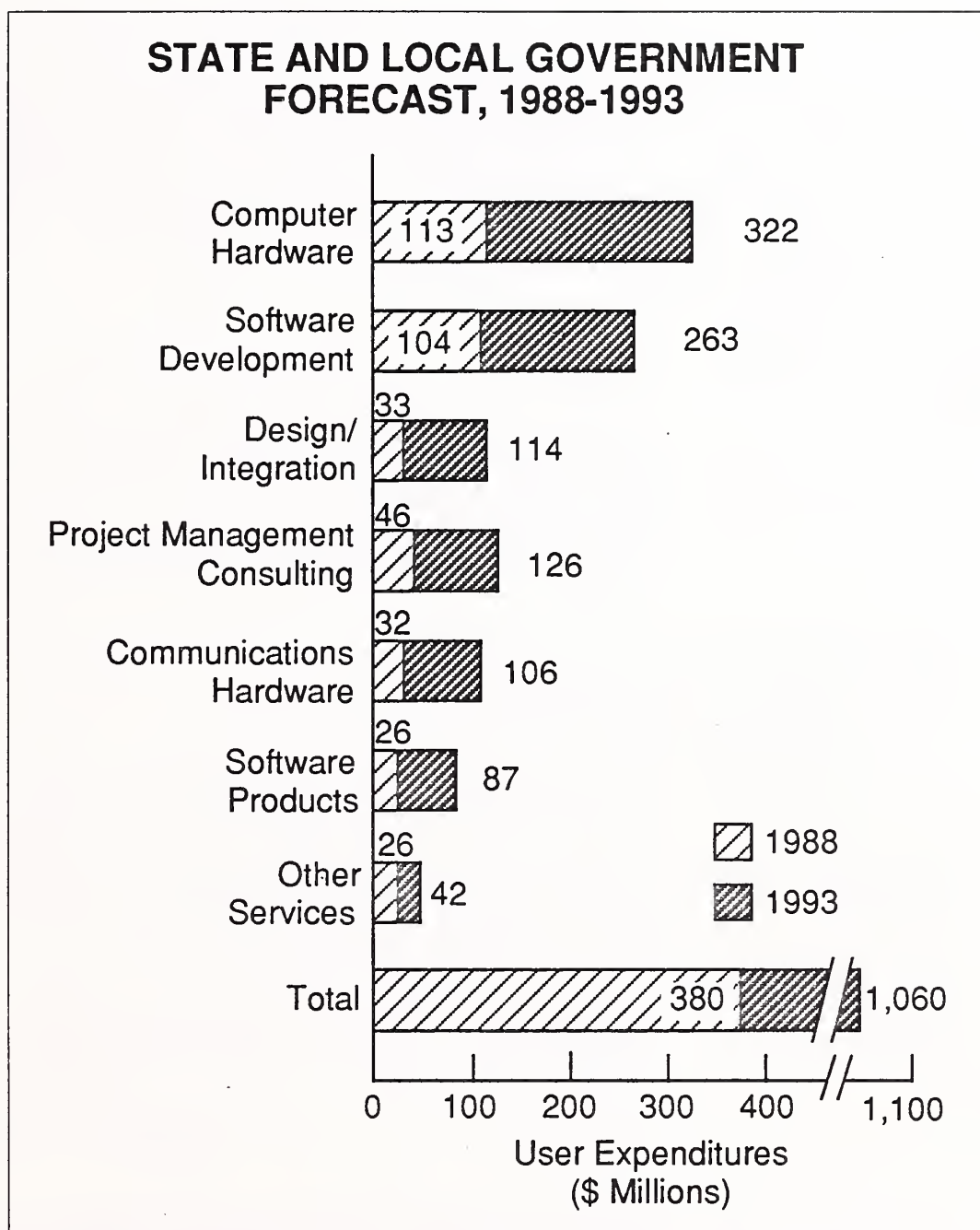
#### **4. CSI Forecast**

The forecast for this sector (in Exhibit IV-16) shows state and local government to be the third largest CSI opportunity market after discrete manufacturing and banking/finance, growing to a 1993 estimate of \$1.06 billion from a base of \$380 million in 1988, at a CAGR of 23%.

Computer hardware is expected to be the largest component, based on the need to replace much of the current inventory. Although software development has the second largest growth prospect at \$263 million in 1993, increasing use of off-the-shelf software will support about \$87 million of products by 1993. Increasing investment in both internal and external networks should result in \$106 million of expenditures for communications hardware in 1993.



EXHIBIT IV-16



The sector was also the third largest in the 1986 forecast, but the compound annual growth rate has declined to tenth for the reasons indicated earlier. The uncertain future of funding through state and local taxes could result in a much lower CSI growth over this period, either through increased process contracting using vendor-owned resources, or continued reliance on moderately enhanced current information resources.

The leading CSI vendors in this market are EDS, IBM, CSC, and Arthur Andersen (Andersen Consulting). WANG has an established position in the office automation segment, and AT&T has position in network implementation. Other vendors with special niches in this sector include American Management Systems, Arthur Young, Coopers and Lybrand, McDonnell Douglas, Boeing Computer Services, GTE, Systemhouse, and STC.

In 1983 Oklahoma contracted for a \$500 thousand workers compensation claims system to be completed in two years by a Big Eight firm; the project took four years and cost \$4 million. The City of Richmond, Virginia, signed an agreement in 1984 with Arthur Young for a billing and information system for water and gas utilities, to be completed in 1987; the contract was recently cancelled. A number of factors, unforeseen at the time each project was initiated, contributed to the schedule and cost overruns.

## I

### Telecommunications Industry

This sector is composed of the major providers of telecommunications (AT&T, MCI, Sprint, GTE, Contel, the Regional Bell Operating Companies (RBOCs), independent local exchange carriers, long-distance resellers, 800 and 900 services, and cellular operators) as well as companies providing broadcasting, cable TV, and optical fiber and satellite networks. As the media available for information transfer expands, this sector may be better described as the "electronic communications industry."

#### 1. Industry Forces

The current interpretation of Judge Green's Final Judgement is causing concern and confusion. Its overturn by appeal or liberalized interpretation are openly argued issues. Users have increasing interest in using full-service providers and have a greater need for services than merely communication paths. At the same time, users are reluctant to have service providers manage their networks.

Industry consolidations that have occurred since the halcyon days of deregulation of telecommunications have begun to inhibit the market since fewer companies now exist as potential CSI customers. There have also been some failures in partnering due to segment competition.

Many telephone companies and RBOCs have formed international units for off-shore sales, just as foreign telephone companies and their subsidiaries are moving into the U.S. market. Some of the more notable firms include Nippon Telephone & Telegraph (NTT), Hong Kong Telephone Company (Comput Asia), Siemens, Alcatel, and Norway EB telecom.

Cellular operations and cable TV companies are beginning to offer Teletex, data transmission, interactive on-line data services, and other features that approach the concept of a computer utility available to the general public. State and federal regulations affecting these services have been loosened to foster competition.

## 2. Impact on Information Systems and Services

Managing all of these changes has been particularly hard in the IS organization where information systems hardware and communications technologies have been generally managed separately. Today, the question is not whether to merge these technologies, but by how much. Their merger not only enables cheaper and faster communications and improved customer service, but also allows for some reduction of personnel, a serious concern of management and unions alike in this highly unionized industry.

The changing cost of services, as well as the impacts of new technologies and availability of newer suppliers of carrier services under deregulatory actions, has led to IS requirements for tools to plan and manage new communications channels such as satellites, fiber optics, microwave, and other new types of data networks.

In addition to the competition that deregulation fostered, Bell telecommunications companies lost a major source of IS support when they were separated from AT&T. This lost capability must now be replaced by in-house capabilities or by external contractors. Bell companies also lost data-processing resources to cost-cutting measures, creating even greater opportunities for CSI vendors.

The new and emerging information carriers, like cable TV, TELETEX, and cellular systems are already using IS to operate billing, traffic and programming management, maintenance scheduling, and marketing programs. They note the need for assistance in providing the capability for planning, flexibility of services, and connectivity between operating elements.

## 3. CSI Potential

Telecommunications firms, while few in number, tend to undertake projects that are significantly larger on the average than the other industry segments. These characteristics tend to be offsetting, making this sector moderately attractive in terms of overall expenditures.

Hardware requirements tend to be below average while custom software development efforts and the design and integration activities required to connect the components are quite large. These expenditures, as a proportion of the "typical" project, are above average.

Telecommunications companies are attracted to CSI because the approach provides the project discipline so frequently missing in recently deregulated businesses. These organizations feel that they can more readily contract project management skills than try to supplement their own in-house capabilities, as noted in Exhibit IV-17.



## EXHIBIT IV-17

**KEY FACTORS IN  
TELECOMMUNICATIONS INDUSTRY****Positive:**

- Internal lack of project discipline
- Network integration opportunities
- Widening range of services requiring support
- Need for EDI and AI-based systems

**Negative:**

- Industry restructuring delay projects
- Perceived in-house technical skills
- Highly unionized workforce
- Foreign vendor interests

Network integration is an important consideration in most projects as are micro/mainframe links while office information systems, and voice/data integration are not. Directory publishing and the advertising and marketing systems that the directories sell are attractive information markets that RBOCs want to serve, in opposition to vendors who performed these services under contract to AT&T and the telephone companies earlier. In-bound telemarketing and marketing through 800 and 900 services are producing significant revenue for the major long-distance carriers. The telecommunications vendors may believe therefore that they know more about network integration and management than the non-communications CSI vendors.

Among the services that communications suppliers desire for improved operations support are EDI (with format subsets like VICS and EIDX), expert systems and service modeling, and AI-based service control systems.

Restructuring of the industry and the entry of a new type of competitor has narrowed profit margins and delayed the early availability of investment funding needed to initiate CSI projects. The regular telecommunications suppliers believe they have the necessary in-house technical skills to complete integration projects.



As noted in earlier SI investigations of the success factors, automation and integration projects can change the way the organization works, introducing culture shock to the ultimate users. Under certain conditions, the highly unionized workforce characteristic of this industry can provide serious opposition to the introduction of new systems that may appear job-threatening.

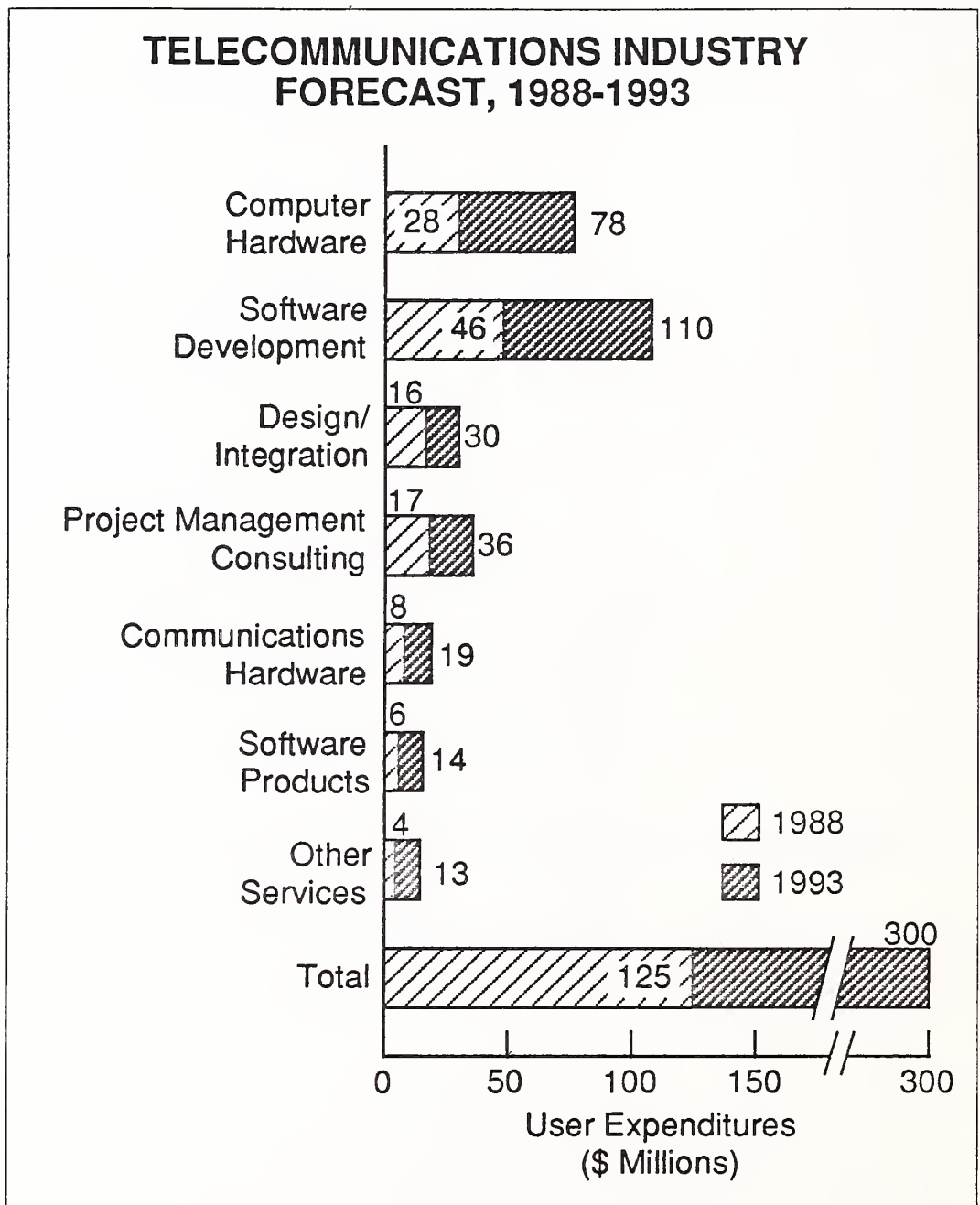
Foreign vendor interests in the U.S. domestic market may involve importation of their own systems integration people, instead of seeking U.S.-based SI vendor assistance. The level of impact will depend on the success of foreign firms identified earlier.

#### 4. CSI Forecast

The forecast for this sector shows growth from a base of \$125 million in 1988 to \$300 million of annual expenditures for CSI by 1993 as shown in Exhibit IV-18. The CAGR of 18% is the lowest of the vertical-industry markets surveyed, down from the 35% projected two year ago. As noted in the earlier analysis, however, custom software development is expected to be the leading component, with only a small amount of off-the-shelf software applicable to this market. The hardware component is now seen as improved over the earlier forecast.

Given a limited number of major establishments, a number of projects already under way, and a "parochial" attitude regarding some CSI skills, this may be a very difficult market to penetrate for all but a few. Computer manufacturers and industry-specialized professional services vendors (e.g., EDS, CSC, BBN) will be the prime CSI competitors. Andersen Consulting and Unisys are also active on recent CSI projects.

EXHIBIT IV-18

**J****Transportation  
Industry**

This sector is composed of airlines, railroads, trucking, and other transportation including shipping, mass transit, postal, and pipeline services.

**1. Industry Forces**

The downturn in the economy has been particularly felt in the transportation industry which is highly dependent on the good health of other industries (farming, steel, etc.) for business. Although concern over the rising cost of fuel has abated, cost containment, increasing productivity, and improved customer service are the common denominators of competing in this market and fending off competition from other modes of transport.

Deregulation of airlines and stiff competition from alternative carriers of air and rail traffic have led to additional declines in business. Complicated and ever changing airfares and rate tariffs create additional needs for enhanced reservation systems that seek to maintain market share. The situation is further complicated by recent decreases in business fare discounts, and mergers put additional pressure on margins. Reservation systems have been split off to reduce conflict of interest claims from other carriers and to make them self-supporting.

Air cargo and air-express competitors have added automation, extended data communications, and bar-code readers to their arsenal of competitive weapons. Only three or four firms are expected to survive. Intermodal shipping companies that combine rail, road, and water transportation modes are on the increase, with several employing sophisticated load modeling tools to improve load efficiencies for improved margins and larger market shares.

## **2. Impact on Information Systems and Services**

Limited growth in IS expenditures is expected. Efforts are underway to control costs and remain competitive. Productivity and efficiency are paramount as establishments seek to reduce personnel costs. IS organizations have been kept small and productive.

Part of the strategy is to replace personnel with technology-driven systems. Technology lowers the cost of overall service by reducing labor costs and at the same time improves the speed of response required to remain competitive. Systems are necessarily communications intensive. Travel reservations systems, crew and maintenance scheduling, and route and load optimization modeling are the current backbone of the industry.

The ability to communicate inexpensively with small, remote sites is also critical to some segments of the industry; whether it is connecting moving vehicles (trucks, ships) or getting basic information (billing, orders, routing) to customers, communications are central to services.

These systems, when properly designed, also provide management with better information for statistical analyses of operations data, rapid response to changing market prices, cost savings to labor and fuel, carrier scheduling, and sales/marketing planning and analysis.

## **3. CSI Potential**

The deregulation of this industry fostered a competitive environment that demands the use of automation technologies as a competitive weapon. Price wars based on more progressive tariff structures have cut so dramatically into revenue that funds for major projects appear limited. This, plus the fact that the industry includes only a limited number of large



transportation companies, significantly reduces the attractiveness of this industry for CSI, as seen in Exhibit IV-19.

EXHIBIT IV-19

### KEY FACTORS IN TRANSPORTATION INDUSTRY

#### Positive:

- Competition and changing rates require support
- Strong need for end-to-end systems
- Network design/integration requirements
- Move to independent traffic management

#### Negative

- Few opportunities outside of airline segment
- Little growth in IS expenditures
- Limited use of outside services
- Limited capital investment availability

There are major opportunities and projects that tend to be larger than the average of other industries. Major expenditures in these large projects involve communications hardware and design/integration services that can support a strong industry need for end-to-end systems that can maximize customer satisfaction and repeat business.

The competitive battleground is largely in the reservation systems required for securing, at a guaranteed price, space for the movement of either people or cargo. Since prices seem to change daily with deregulation, and the agents who need this up-to-date information are dispersed over vast areas, meeting networking requirements are paramount to the industry.

CSI will be attractive to client organizations that want to solve problems of how to make changes to a complex system both easily and while in the operating mode. CSI vendors can offset the recognized technical weaknesses in internal staff as well as their limited capabilities in project management, and should be prepared to address the concern of many IS managers regarding the directions of IBM and the hardware likely to survive.



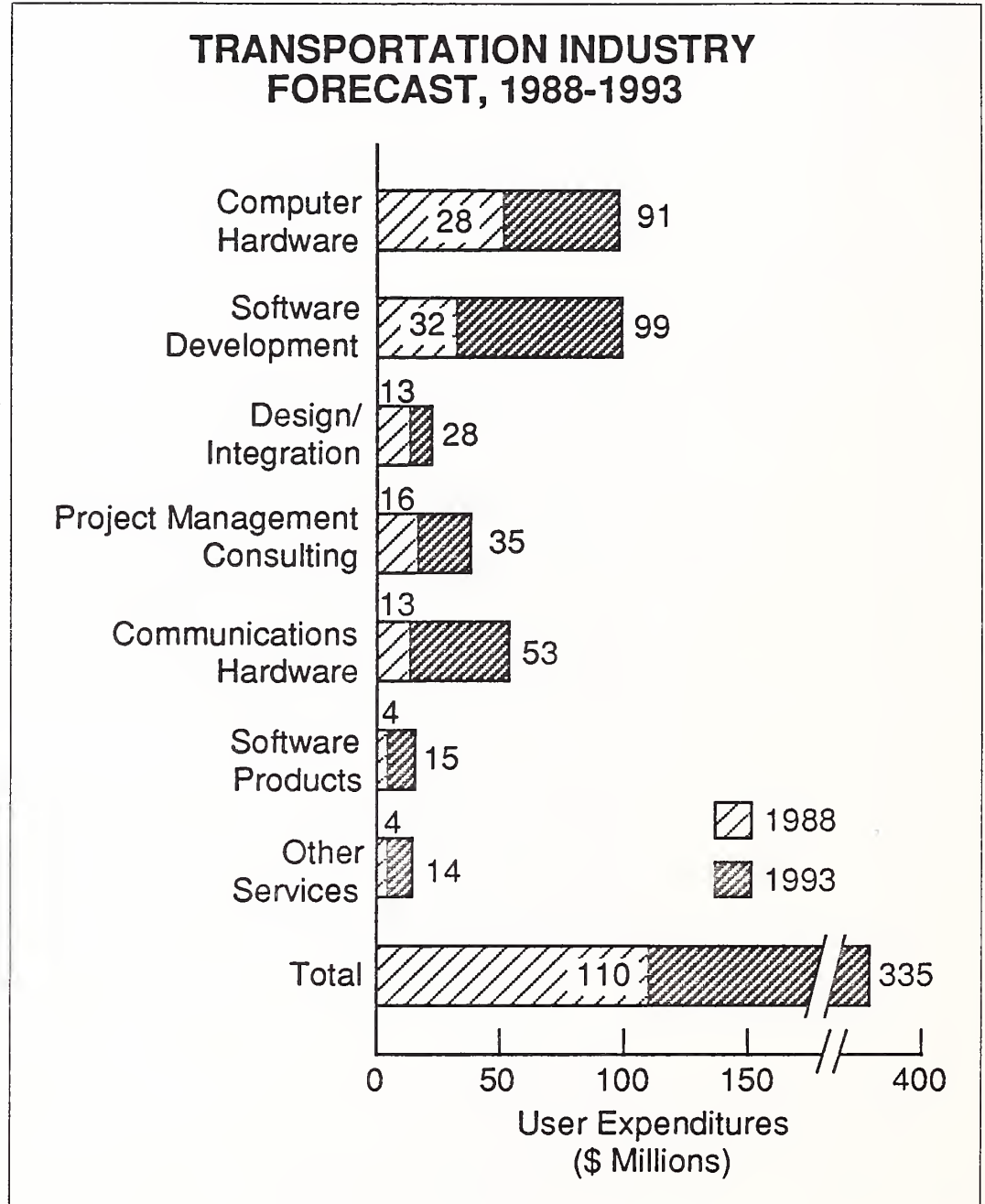
The most unattractive features of this market are the limited number of projects and the low level of anticipated expenditures outside the airlines segment. Beyond major airlines, the industry is not economically capable of supporting many large projects, nor are these other segments particularly accustomed to either the use of technology or the need to acquire development expertise. Increasing labor and materials costs have limited the available capital investment.

#### 4. CSI Forecast

The forecast for this sector, seen in Exhibit IV-20, shows that from a base of \$110 million in 1988, CSI yearly expenditures are expected to grow to \$335 million by 1993, at a CAGR of 25%, the next to the lowest growth rate. This rate is lower than forecasted in 1986, before consolidation of some reservation and traffic management systems began. The new rate reflects the current softness in expansion of the industry, which is unable to support the investment needed for aggressive CSI projects. Software development and hardware acquisition are nearly equal value components, considering the industry's special but limited requirements. Communications hardware is expected to play a significant role in the demand for extended connectivity.

The principal competition for CSI projects are expected to be computer manufacturers like IBM and UNISYS teamed with smaller, sector-specific vendors. Andersen Consulting and EDS have also become active in this marketplace in the last two years. The number of significant competitors is expected to remain small.

EXHIBIT IV-20

**K****Utilities Industry**

This sector includes the energy market (electricity generation-coal/nuclear/hydro/oil/solar/geothermal, and gas generation), water utilities, and sewage/waste disposal and treatment, but excludes telecommunications.

**1. Industry Forces**

Until the beginning of the 1980s, most of the utilities industry was not under serious competitive pressure. Each utility acted in a geographic monopoly and had little concern for competition, focusing instead on day-to-day business, within constraints established by state utility commissions.

The sector has nevertheless been a stable consumer of external services. Contracts are typically large and multiyear and mainly the province of engineering and construction firms. Changing price structures, alternative energy sources at competitive rates, and dedicating resources to marketing diversified products are some of the current strategies.

The poor condition of utility balance sheets results from the enormous cash drain many utilities have suffered as a result of litigation, project overruns, environment clean-up measures, and in particular nuclear power plant construction. The situation is unlikely to be resolved in the near future.

## **2. Impact on Information Systems and Services**

IS has been forced to shift from a comfortable day-to-day operating orientation to one where they must meet dynamic demands within constrained budgets. Management has directed IS to help in enhancing operating efficiency and productivity to make the utility more profitable and reduce costs while increasing the ability to serve users. Cost containment remains the principle focus of all operations support activities.

IS management's attention is turning to data communications requirements that will make systems available to users, even at remote locations. Many of the support systems are being changed from batch to on-line, and issues regarding the proper use of advanced technologies and distributed versus central processing are now being addressed in new systems.

## **3. CSI Potential**

Utilities are discovering the use of technology for maintaining a competitive edge. Customer files are becoming marketing data bases to improve service to customers and to market new products. AI-based automated process control is helping to minimize materials consumption and optimize resource applications as noted in Exhibit IV-21.

There is much more interest in long-term hardware planning and the curtailment of rapidly escalating operations and management costs associated with outdated equipment. Corporate management appears to be more aware of the role of IS, in responding to the growth of end-user computing and the need for better data administration, and to assure compliance with federal and state regulations. End users are buying more ADP power and making the IS director more of a data manager and technical coordinator than head of processing.

## EXHIBIT IV-21

**KEY FACTORS IN UTILITIES INDUSTRY****Positive:**

- Increasing competitive use of technology
- Hardware/software obsolescence
- Automation of repetitive tasks
- Automated remote-control applications

**Negative:**

- Day-to-day orientation of IS
- Limited number of establishments
- Financial constraints
- Modular, rather than total, view of system

Despite long-term opposition to the use of automation to remove, or reduce drastically, the role of manpower in control of utility operations, management has begun to employ computer-aided equipment that will perform repetitive tasks with minimal supervision. This equipment can become part of a CSI project. Automated remote-control applications made possible by new technologies are also being targeted by utilities.

Among the negative factors to the extension of CSI in this market is the continuing day-to-day orientation of IS and their reluctance to expand beyond current capabilities. Another factor is the limited number of utility establishments, particularly in gas and electric utilities.

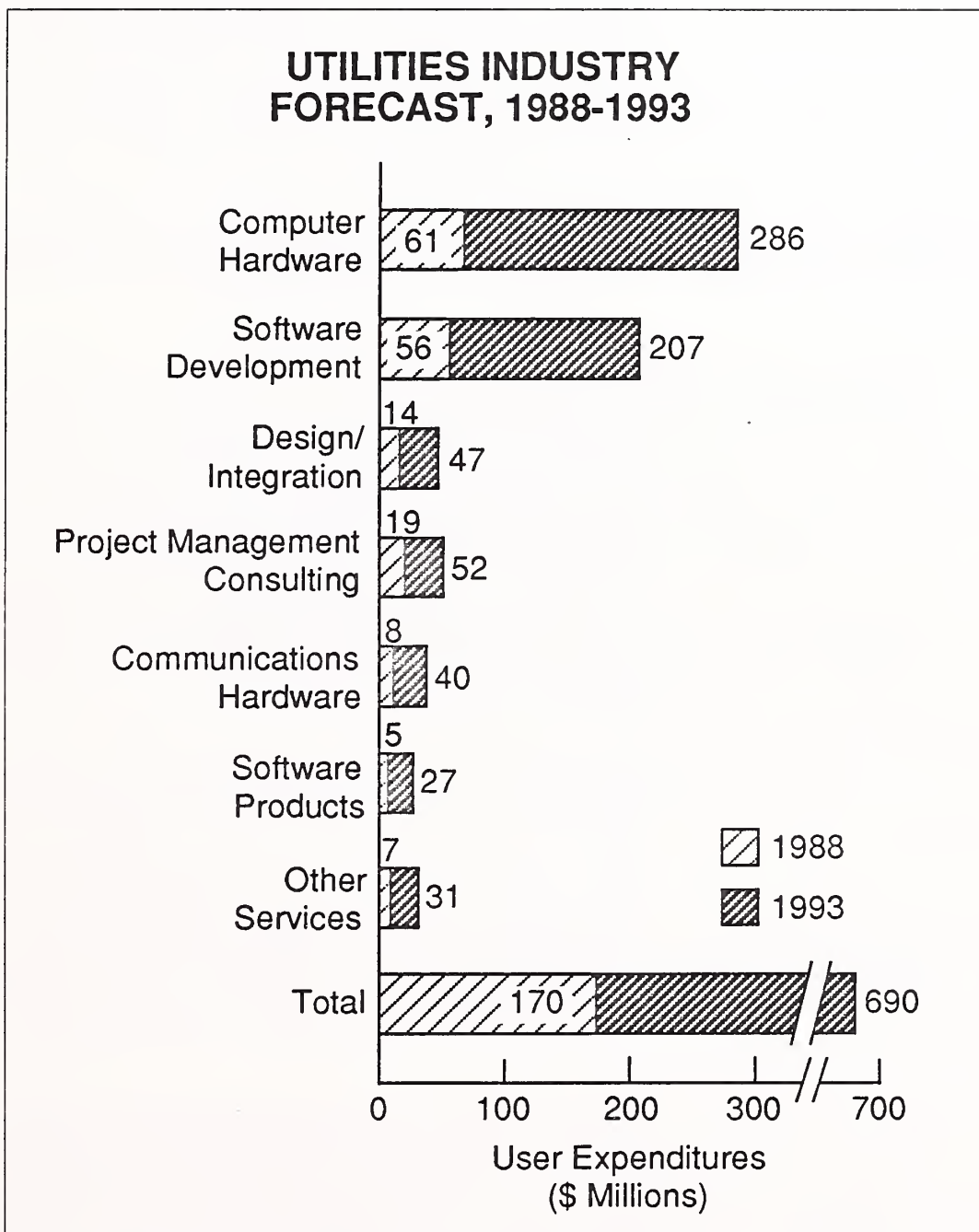
Under the consumer-oriented constraints imposed by regulatory and environmental authorities and the resultant low ROI, investments are limited and prevent implementation of a number of desirable improvements in data and control systems. Operating executives have modular, rather than total views of the systems, restricted to raw materials, processing, maintenance, or customer relations. Traditional views are slow to be modernized in this basic industry.



#### 4. CSI Forecast

The forecast of CSI in this sector shown in Exhibit IV-22 estimates that approximately \$170 million in CSI will be expended in 1988. By 1993, these expenditures will climb to \$690 million at a CAGR of 32%, somewhat less than the 35% projected in 1986.

EXHIBIT IV-22



IS hardware and custom software development expenditures will dominate most projects, since the large utilities have a strong interest in modernizing their systems to include applications for estimating user demands for electricity, gas, water, and the like. Equally strong are the interests in managing these commodities and developing automated systems for the collection of usage data. Use of hand-held and remote meter readers are examples.

Since many of the operations and accounting applications are new, there will be minimal demand for off-the-shelf software packages. Customized software will be needed for hazardous conditions monitoring, load-and-exit control, distribution and collection station control systems, and more modern customer service systems.

In view of the limited opportunities in this market, only a few CSI competitors are prominent. CDC and IBM lead among hardware-based vendors and Telenet appears in network and distributed processing projects. Bechtel, Fluor, Systems Control, and EDS/GM appear as hardware independent systems vendors.

## L

### Wholesale Distribution Industry

This sector includes establishments that sell goods to retailers or industrial/commercial/institutional groups acting as brokers.

#### 1. Industry Forces

The wholesale distribution market is comprised of a number of widely different submarkets with widely different growth rates. Some very large wholesale establishments are leading-edge users of information technology, but many more, in the thousands, are very small. There are three types of firms: independent distributors (merchant wholesalers) who account for about 55% of sales; manufacturer's sales branches which generate about 35% of sales revenues; and agents and brokers who handle somewhat less than 10% of sales and whose numbers are contracting.

This industry sector is one of the largest in employment, including many small firms. The entire industry is impacted by continuing pressure on profit margins (on the order of two to three percent) resulting from the costs of financing and storing inventory, transportation, order processing and carrying account receivables. Manufacturers and retailers contribute to the pressure with reduced inventories, demands for quick response, JIT (just-in-time) delivery schedules, and competition from foreign wholesalers.

Measures to ease the pressure on margins include increased inventory turnover, secured high-volume purchases, longer and larger purchase commitments, and automation improvements that contribute to the "bottom line" by enabling rapid response and deployment of products. Better communications will accelerate the information flow between wholesalers, retailers, and manufacturers/sources of goods. Back-office use of computer-to-computer order processing will reduce the time needed to locate and deliver merchandise.

Automation is viewed as a matter of survival by the independents and manufacturer branches. The leaders forecast an aggressive computerization solution to current margin pressures.

## **2. Impact on Information Systems and Services**

IS in the medium- to large-sized wholesale organization is faced with meeting rising management expectations and satisfying increasing demands for the integration of data and applications, while managing the limited technical investment. The mission is complicated by the traditional instability of the sales-oriented organizational environment and its varying use of information services.

IS is also faced with the increasing importance of data-integrity in an environment where PCs are beginning to proliferate in management. Proposed solutions must be proven in the market or submarket to support early payoff. Integration problems abound from the piece-meal installation of hardware and packaged software, supported by in-house or short-term consultant professionals.

Productivity of the IS staff is frequently impacted by varying backlogs of short-term or one-time application demands. Users in sales, management, and traffic are demanding increasing complex tools, such as new workstations, upgraded applications, and on-line teleprocessing to gain a competitive edge. To meet these demands, IS is looking to applications that run on less expensive computers, expanded connectivity, and network techniques such as EDI.

Conversely, the cost constraints limit the level and availability of in-house staff to address these issues with the latest technology, while meeting day-to-day service requirements. In addition, IS managers are having difficulty gaining any meaningful insight to future industry directions that would influence the selection of information technologies.

## **3. CSI Potential**

There are about 30,000 wholesale distributors with \$5 million to \$20 million in sales per year; 6,000 have revenues in excess of \$25 million and 1,000 or more employees each. These firms are expected to be the principal sources of CSI opportunities.

Near-term industry interests will emphasize improving and integrating external and internal communications as noted in Exhibit IV-23. EDI between trading partners in the retail, wholesale, and manufacturer/merchandise source can be provided by network service firms like GEIS, ADP, and McDonnell Douglas, or incorporated into new dedicated networks as part of upgraded data systems.



## EXHIBIT IV-23

**KEY FACTORS IN  
WHOLESALE DISTRIBUTION INDUSTRY****Positive:**

- Network requirements
- Potential for EDI applications
- Strong interest in inventory turnover
- Automation needed for survival

**Negative:**

- Infrequent user of outside services
- Smaller than average project expenditures
- Widely different submarkets
- Broad applications challenges

The strong interest in improving inventory turnover rates to reduce financial pressures and risks is also expected to gain early funding. Only a small number of wholesalers are currently employing distribution resource planning (DRP), with inventory modeling, automated warehouses, and OLTP resources. More of the firms are expected to move in this direction to remain competitive. Automation is needed for survival, and the more progressive managements will adopt CSI programs, if the contribution to the bottom line can be demonstrated.

Very much like the retail distributors, this sector has not made use of outside services except for hardware maintenance and essential software support. In an industry largely guided by merchandising intuition, using relatively small IS staffs, and financially constrained by narrow margins, there have been smaller than average CSI project expenditures.

Part of the problem is attributable to the existence of widely different submarkets, where CSI vendor's experience might be seen as relatively narrow. Each submarket sees itself as having unique requirements that can only be addressed by knowledgeable specialists.

From an information technology view point, however, this market offers broad applications challenges which could be addressed by technology and tools already employed successfully in other markets. The market-

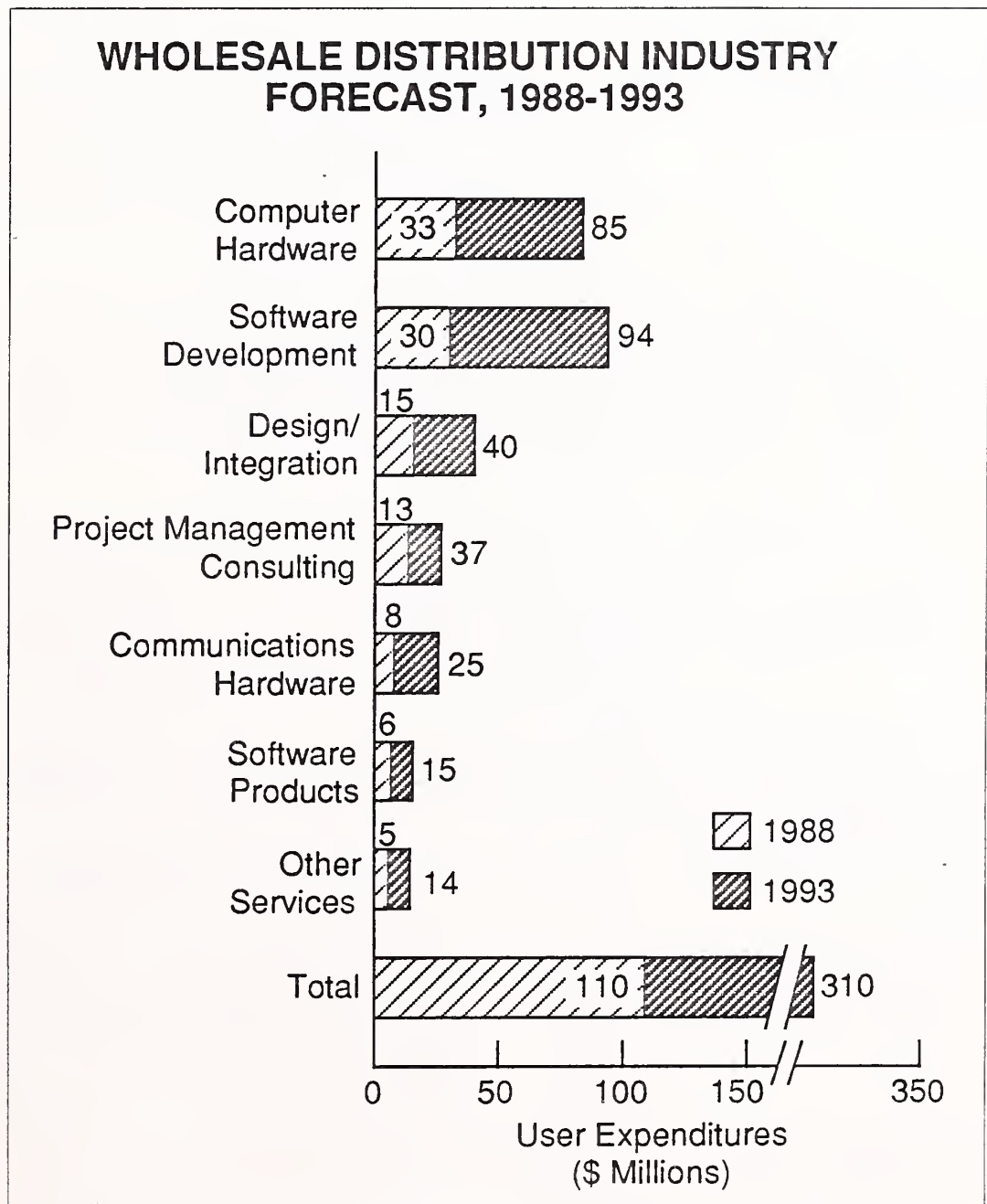


ing of CSI capabilities may have to be shaped to offer phased improvements over time, to stay within the stringent cost envelope of the industry.

#### 4. CSI Forecast

As noted in the discussion of the retail distribution industry sector, wholesale and retail were treated together in the 1986 to 1991 forecasts. The wholesale distribution industry is expected to reach less than half the level of retail. From a base of \$110 million in 1988, this sector will increase to about \$310 million in 1993 at a CAGR of only 23%, (see Exhibit IV-24). This rate of growth is only slightly more than half the retail growth rate.

EXHIBIT IV-24



Also similar to the retail sector, software development is expected to be the most significant component, with a corresponding small growth of software products resulting from the wide diversity of submarket needs. While computer hardware will be the second largest CSI component, it reflects the industry's interest in employing newer but less expensive equipment.

The relative low value of CSI projects thus far, and the widespread nature of the industry, provides for a market not dominated by any particular vendor. IBM provides most of the platforms and has managed a number of small projects. EDS has also ventured into this market. Smaller firms with some interesting assignments include Innovative Teletronics, Sentinel Computer Corporation, and CRT Distribution Systems Inc.

## M

### Other Industries

The other industries sector includes education, agriculture, automotive rental, parking and repair, third-party maintenance, construction, hotel/motel and lodging, non-profit membership organizations, and recreation and entertainment services.

#### 1. Industry Forces

In each of the industries in this sector there are a few large dominant firms that are capable of supporting large projects. The difficulty is finding these opportunities among the multitude of establishments included in this category.

Education is subdivided into academic and industrial/commercial segments. The academic segment includes both public and private institutions that provide basic education from kindergarten through 12th grade, vocational schooling, community colleges, and institutions of higher learning for undergraduate and graduate study. Vocational schooling is available at both the 10th to 12th grade, and post-high school business, trade, and technical facilities. Each of these employ administrative, academic, research, and library computer applications.

The agricultural industry operates at several levels, from the large combine agribusinesses, to small- to large-sized single farms in specialized produce, to animal- and fowl-based and related product businesses. Included with this industry are forestry and commercial fishing, hunting, and trapping businesses. Information applications have been extended from the large multisite agribusiness establishments down to PC-based local farm and animal husbandry installations. Applications include crop planning, feed and livestock records, financial and budget planning, and standard accounting functions.

This industry has experienced sharply reduced margins due to foreign competition, environmental conditions (drought and flooding), higher equipment costs, increasing labor costs, and adverse economic conditions. While the averages have fallen, there are a number of subsectors that have experienced sustained growth.

Record keeping to track parts, customer charges, and orders—as well as an increased need for diagnostic systems in repair service and competition in auto rentals—characterize the automotive services market. In the hotel, motel, and lodging segment, overbuilding and a need to differentiate service have increased the importance of controlling the level of service and costs. Nonprofit organizations are under increasing pressure to provide mailings, magazines, and other services to compete for and hold members. Recreation/entertainment is characterized by a need to recruit and retain employees at low salaries and to economically manage, administer, and report on activities, events, services, and/or franchise operations. All of these activities have encouraged the use of computing for record keeping and accounting.

## **2. Impact on Information Systems and Services**

The larger educational institutions employ IS staffs to operate both academic and business centers. The academic support includes library support, timeshare mainframes for computer studies, and courseware of varying complexity. The administrative functions include class and teacher scheduling, student records, building and equipment maintenance, and the usual range of payroll, finance, and accounting functions.

New requirements being imposed on educational IS include desktop publishing, business consulting and advertising, professional services, and expanded external data/information acquisition and distribution. In higher education facilities, supercomputer access and computer-aided research requirements continue to increase.

The medium- to large-size agribusinesses and cooperatives use centralized IS to provide the usual range of computer-based services. New requirements include expanding PC networks and networks that connect to research institutions including government centers, county agencies, and distribution channels.

Connectivity and integration are also needs that must be considered in view of interlocked functions in the sector. Vendors must become familiar with these needs to successfully sell construction companies, hotels, or automotive service companies.

End-user participation is a critical issue for IS managers. Where users are not running systems, their assistance is necessary to develop requirements and application systems. Education, training, and support must be sup-



plied to help users meet this challenge from a very limited budget in most cases.

The impact of technology that can be used in the business or that can make information systems more useful and economic is an issue for IS managers, who must be prepared for changes in this volatile sector. Lower-priced PCs, new types of storage technology, and more network capabilities can have a sizable impact on information system use.

### **3. CSI Potential**

From a sector point of view, the number and size of CSI project opportunities are less attractive than those of other industries. However, there are projects of significance in these industries that should not be overlooked.

Statewide systems that link remote campuses and inter-campus networks represent opportunities in the higher education marketplace. Statewide integration has been completed by less than 15 state-level college/university systems, and of a potential 2,200 institutions, only 150 have completed campuswide networks.

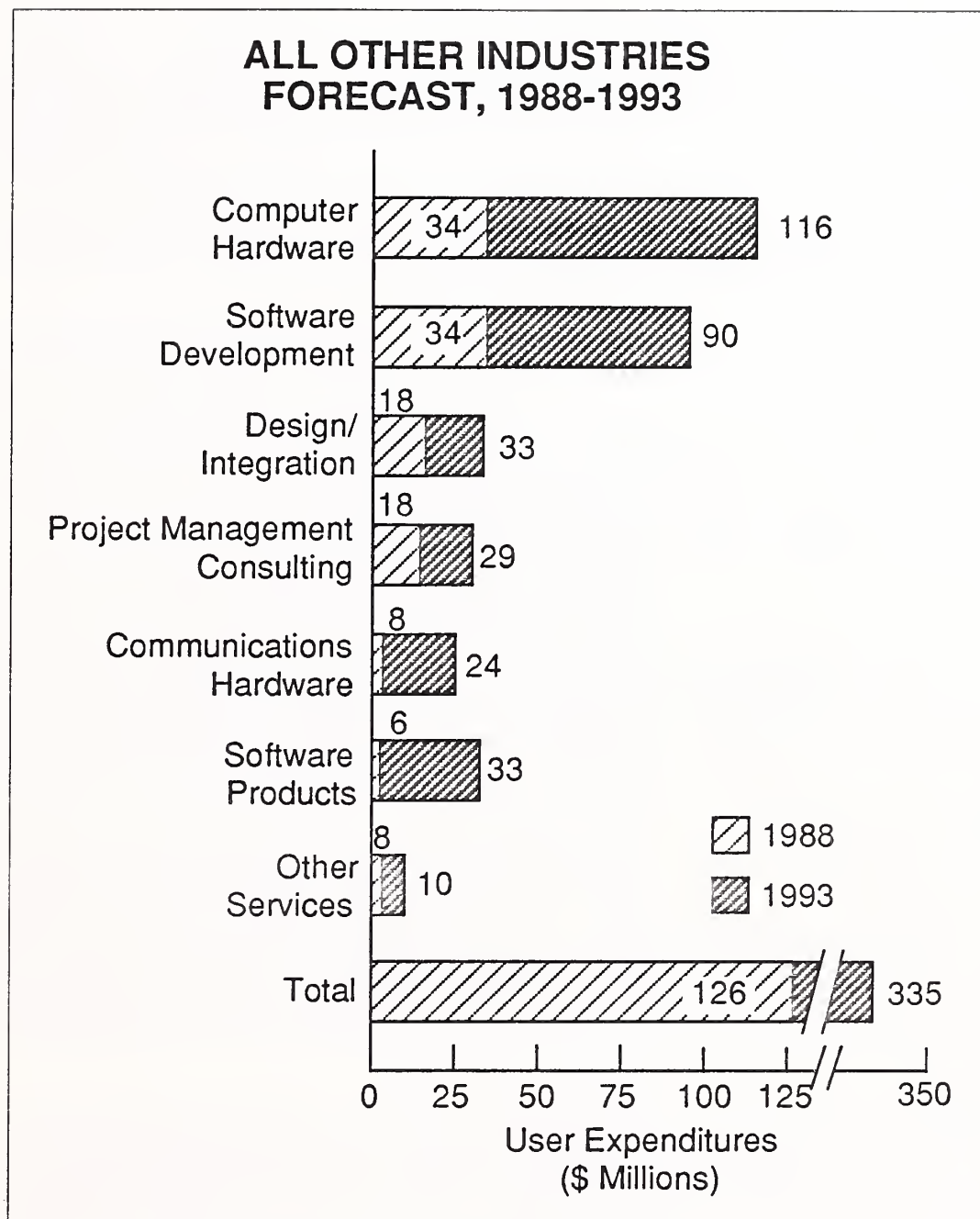
Agricultural investments are now provided by both domestic and foreign sources. Large crop facilities in cereals, basic foods, and high-value products require large networks between seed and fertilizer sources, large farm machinery maintenance organizations, transportation and distribution companies, and both domestic and foreign agriculture markets. A number of mergers and acquisitions have increased demand for CSI-type projects.

### **4. CSI Forecast**

This sector previously had the smallest expenditure level of the vertical industry sectors. New data increased the size of the CSI market to a base of about \$125 million in 1988 growing to about \$335 million in 1993, at a CAGR of 22%. The hardware and custom software components will account for more than half of the expected expenditures. The growth rate of the current forecast is much lower than expected in the 1986 SI market report, but the base level has materially grown in 1987 and 1988 as seen in Exhibit IV-25.



EXHIBIT IV-25



Hardware manufacturers like IBM, CDC, DEC, and HP appear to have some programs based on the prevalence of their platforms. Turnkey systems provided by VARs appear to more frequently acquired for the more numerous medium-sized organizations.

## N

### Federal Government

This sector includes defense and civil departments, independent agencies, and public corporations, but excludes weapons and platforms, and classified applications, such as embedded computer systems, intelligence, and tactical command and control systems.

## 1. Industry Forces

Federal executives are faced with the need to improve productivity, to do more with less (effort, staff and funding) and expect to accomplish this through increasing reliance on information technology. They have enunciated a commitment to maintain and enhance existing information systems, while automating manual and semi-automatic processes and new applications.

All agencies are faced with critical staff shortages in the face of budget deficit pressures and unfavorable personnel hiring and retention conditions under present Office of Personnel Management and Congressional restrictions. The Reagan Administration moved toward more privatization of public data bases and contract management to overcome the increasing difficulty of acquiring strong technical and professional personnel. The REFORM 88 Initiative discouraged acquisition of unique software to foster information resource sharing with transportable software and applications, replacement of obsolete equipment, and integration of numerous standalone systems. GAO and GSA studies continue to uncover flaws in large system acquisition planning and implementation that lead to schedule slippage, cost overruns, and the real threat of delivering a system not suited to the latest processing requirements.

The federal government market has established a number of problem identification and procurement procedures aimed at encouraging competition while acquiring an information system with realistic life-cycle costs. Inadequately trained procurement specialists, a shortage of qualified large-system program managers, and an almost continuous legislative oversight process does not always assure acquisition of the most effective solution.

The federal government was the earliest to employ systems integration methodologies, and usually advises industry of its intentions long before the solicitation documents are issued. The government applies some very sophisticated tools to determine the relative adequacy of proposed systems solutions. Identifying and tracking opportunities in this sector is substantially easier than in the commercial and state and local government sectors.

## 2. Impact on Information Systems and Services

Federal IS budgets are aimed toward greater functionality of the information resources. Most IS organizations are committed to maintaining quality support to their agencies, but are continually faced with rising service-level and applications demands, obsolescence of a certain percentage of resources, and rising maintenance costs. A major share of existing software was custom developed by contractors and in-house staffs to satisfy applications that have been extensively modified over time.

Hardware and software maintenance impact both the availability of IS staff to do new applications development and to staff internal systems integration projects. New demands for technical assistance to end users equipped with PCs or advanced workstations are also reducing staff availability for new projects.

Implementation of FTS-2000 and its expected competition with existing data networks is also increasing the workload of IS staffs who have only recently acquired technical assistance for telecommunications design and planning created by the AT&T deregulation orders.

New and upgraded or replacement system requirements are emphasizing improved service to end users, data integrity, relational data base systems, improved system security, and transparent connectivity. Departmental DP services are being decentralized but extensively networked to satisfy the demand for executive information systems and decision-support systems.

New applications involve the use of AI in software development and situation modeling, standard financial/payroll/personnel systems, and EDI. PC acquisition and application continues at a much higher rate than earlier anticipated, further burdening the IS technical staff.

### 3. CSI Potential

The federal SI market is currently as large as the combined commercial market, as agencies press for more flexible and advanced resources to meet rising executive, legislative, and citizen service expectations. The expenditure rates are expected to decline in the 1990s but will continue at a positive level throughout the decade, as seen in Exhibit IV-26.

As indicated earlier, agencies are looking for integrated systems that will improve the productivity of both staffs and facilities, without significant operating budget increases. Existing personnel policies and the heavy software maintenance load extends shortages of in-house technical staffs. Implementation and initial operating support must come from commercial organizations to meet the service demands.

Since there is always an element of uncertainty associated with the implementation of new information technology and higher capacity resources, the federal agencies have moved to a policy of sharing implementation risks with the successful vendor. Despite the risk of new service demands exceeding the capacity and capability of SI projects, federal procurement has moved to the increased use of fixed-price contracts.



## EXHIBIT IV-26

**KEY FACTORS IN  
FEDERAL GOVERNMENT MARKET****Positive:**

- Productivity improvements
- Technical staff shortages
- Shared implementation risks
- Information technology upgrades
- Service demand increases

**Negative:**

- Deficit-limited budget
- Greater protest activity
- Existing systems maintenance
- Slow standards implementation
- Extended implementation schedules

User-based service demands continue to increase, steadily exceeding the ability of the in-house IS staff to satisfy the latest needs. Contractors expect to provide up to full operational support of newly implemented SI projects for periods of up to ten years after acceptance.

Several factors do inhibit the FSI market. The two most significant are expected budget cuts to reduce or limit the federal deficit and greater protest activity by disappointed bidders. Budget restrictions are forcing consolidation or outright cancellation of a number of agency desired FSI projects. The increased protest activity is extending the procurement cycle time, expending critical energies, and forcing agencies to more carefully review planned system acquisitions.

The cost of existing systems maintenance continues to rise rapidly, diverting support funds that are needed to acquire system upgrades and replacements.

Implementation of new information system standards that would both foster greater competition and substantially improve connectivity be-

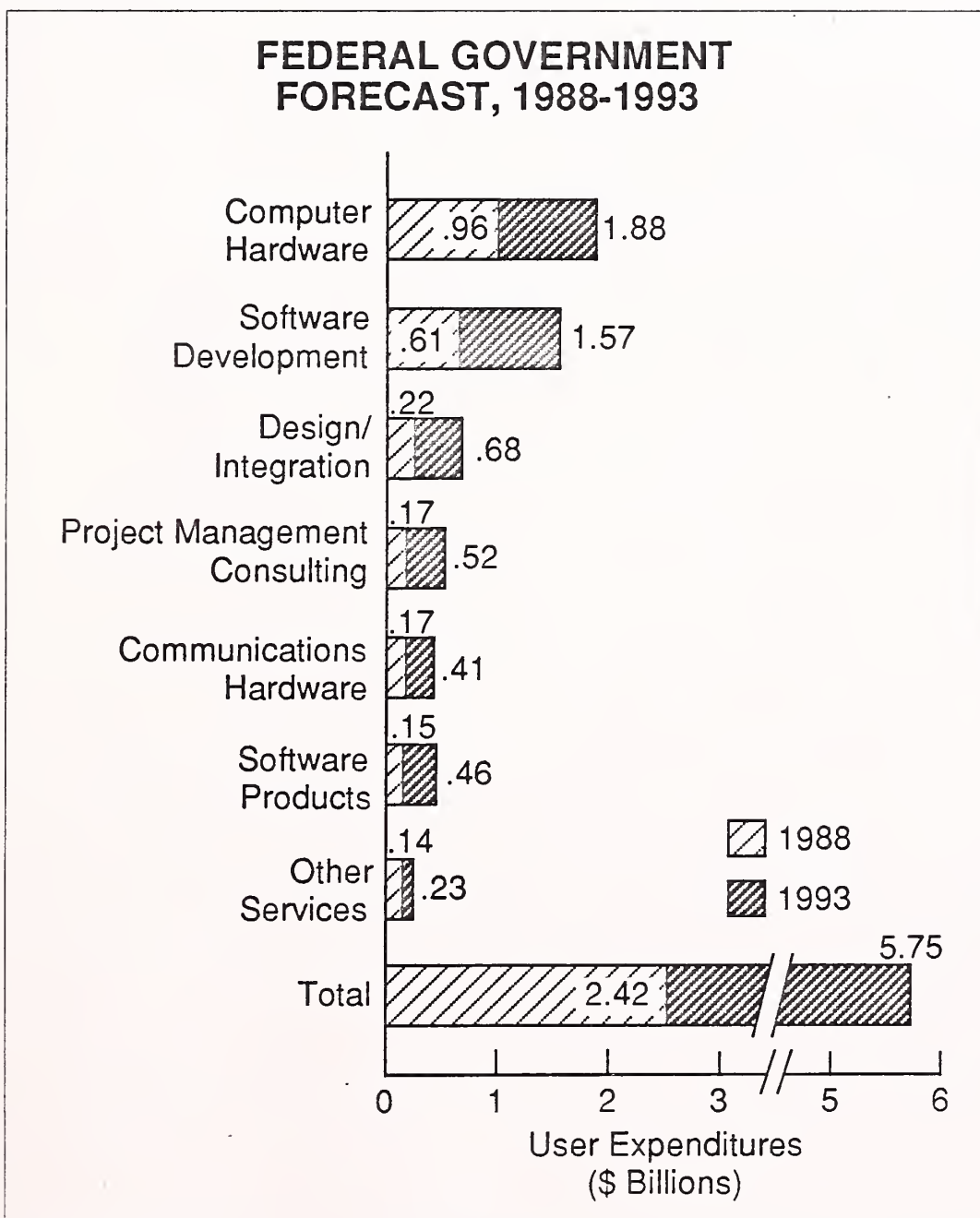


tween systems has been dragging on. Vendors with competing operational parameters are not supportive of early standards and the civil agencies would like to take advantage of newer technologies with minimal restrictions.

#### 4. CSI Forecast

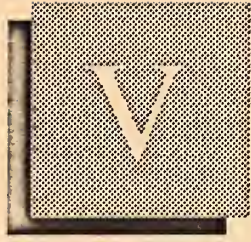
The federal government sector forecast for FSI shown in Exhibit IV-27 is expected to rise from a 1988 base of \$2.4 billion to a level of \$5.7 billion by 1993 at a CAGR of 19%. The hardware and custom software development components will increase rapidly. Software product acquisition is continuing to rise under prodding by GAO and GSA, but there are sufficiently unique applications in the government to justify, in their view, the high rate of custom software development.

EXHIBIT IV-27



The base amount for 1988 is substantially higher than that reported in the 1986 forecast, but in line with INPUT's latest *Federal Systems Integration Market* report. The release of a number of significant contracts for Defense, space, Social Security, Transportation, and Treasury programs boosted both the base and the CAGR.

The continued growth of FSI has attracted an increasing number of potential systems vendors. While there are opportunities for a number of smaller vendors, the leaders include: IBM, Digital, and Unisys among the hardware vendors; BCS, MMDS, GDS, and TRW in aerospace; CSC, EDS, and PRC as hardware-independent system's suppliers. AMS, AGS, Systemhouse, and Booz-Allen Hamilton are also among the leaders.

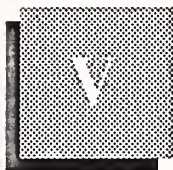


# SI Project Data Base Analysis









# SI Project Data Base Analysis

## A

### Project Data Base, 1987-1988

INPUT collected information on over 420 information resource projects initially identified as SI projects. The projects were then investigated to develop sufficient data to permit analysis, and to better understand the characteristics of the projects, in terms of the clients who paid for the systems, and the vendors that implemented each of them. Commercial (including state and local government) and federal government projects were included in the data base.

#### 1. Screening Criteria

The screening criteria selected for qualification for the SI project tracking and reporting in the separate INPUT Systems Integration Project Reports (SIPR) volume are noted in Exhibit V-1.

- The candidates were limited to those currently underway or completed no earlier than 1986. Older projects were not expected to demonstrate distribution of project components typical of present client requirements.
- Projects to be included must be or have been managed by an outside vendor and not the client's I.S. department, or a consultant separately hired by the client. While the initial emphasis was placed on projects that essentially met the SI definition, details were also collected on applications that were managed by client personnel for later secondary market analysis.
- Substantial vendor involvement was required, including two or more project components: computer/communications hardware, packaged software, custom software development, professional services, and/or other engineering services or processing/network support.

## EXHIBIT V-1

**PROJECT TRACKING SERVICE  
SCREENING CRITERIA**

- Project completion after 1985
- Internal IS not project manager
- Substantial vendor involvement (not limited to software only)
- Not foreign project
- Information (computer/communication) application

- The candidate program was domestic or U.S.-based and not a foreign project, since the primary emphases of this program is the U.S. market.
- The projects were restricted to information resource (computer/communications) applications. Automation projects that excluded direct information transfer, such as robotics and automated vehicles or handling equipment, were not included in the survey.

Initially, the screening criteria also required the project to be valued at not less than \$5 million, be multiyear implementations, and exclude subsequent operations support (facilities management). The size criterion was reduced to about \$1 million to increase the data base size, and no minimum implementation period was required. Facilities management during the initial contract would be included under professional services, but subsequent contract renewals would not.

**2. Data Base Status**

By the end of 1988, 128 projects had been processed through the screening process and had been described in the SIPR as shown in Exhibit V-2. About 190 projects were not fully described, for a variety of reasons including: not yet awarded, value or component mix declared proprietary information, or currently suspended. Some of these projects do have call-back agreements for inclusion in the 1989 data base.

## EXHIBIT V-2

**SI PROJECT DATA BASE, 1987-1988**

	Commercial	Federal
Projects analyzed		
Completed	93	35
In progress	133	56
"Suspects" resolved and not used	115	-
Total	341	91

The number of "suspects" that did not pass the screening process was 115. About half of these have been identified as in-house projects which were not planned to be included as part of the 1988 analysis effort. One-quarter were not actual SI projects by definition, and the remaining quarter of the unused projects were inadequately described. The needed information was unavailable at the time of this analysis.

The current computerized version of the data base lacks certain refinements needed to make it more effective and easier to use. Part of the 1989 program will include an examination of better ways of presenting the data, verification of the project classification and component value data, and an indication of the level of post-implementation support, FM or maintenance, included in the contract.

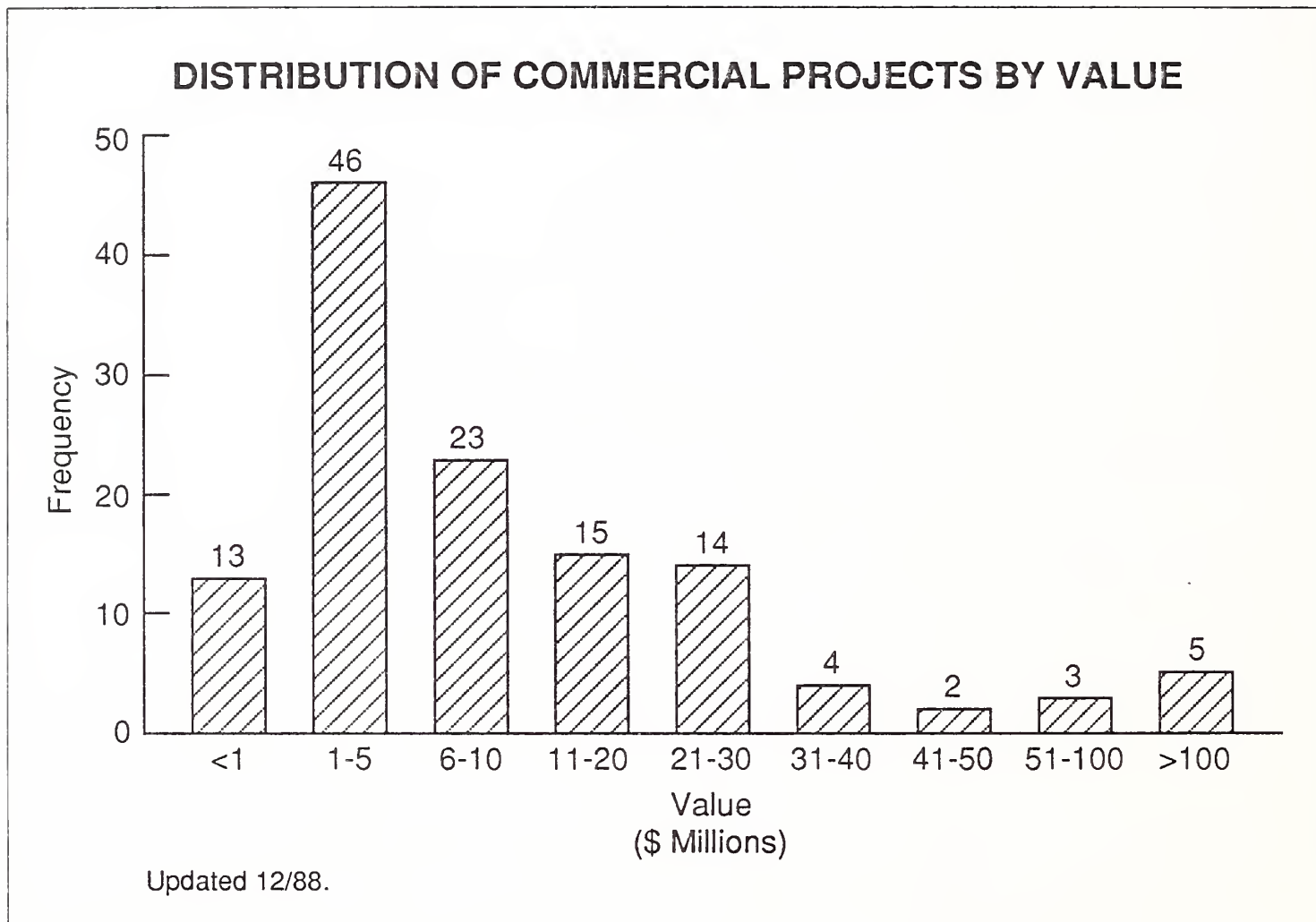
**B****Distribution of  
Projects by Contract  
Value**

CSI and FSI projects were separately analyzed, except where comparisons were deemed useful. The initial analysis was based on contract value. The number of projects captured with award values of \$5 million or more was lower than anticipated. The large number of lesser valued projects led to lowering of the minimum contract value to \$1 million, and subsequently, to \$0.5 million.

## 1. Commercial SI Projects

The distribution of the commercial SI projects is seen in Exhibit V-3, which is the latest version of the chart shown at each of the SI seminars.

EXHIBIT V-3



The large number of data base projects valued at \$5 million or less demonstrates the rationale for relaxation of that criterion, in response to suggestions of current program clients. That number is matched by contract values from \$6 million to \$50 million, with only eight reported projects worth \$51 million or greater. One factor illustrated by the predominance of lower value projects is that only a relatively few include post-implementation operation support (facilities management).

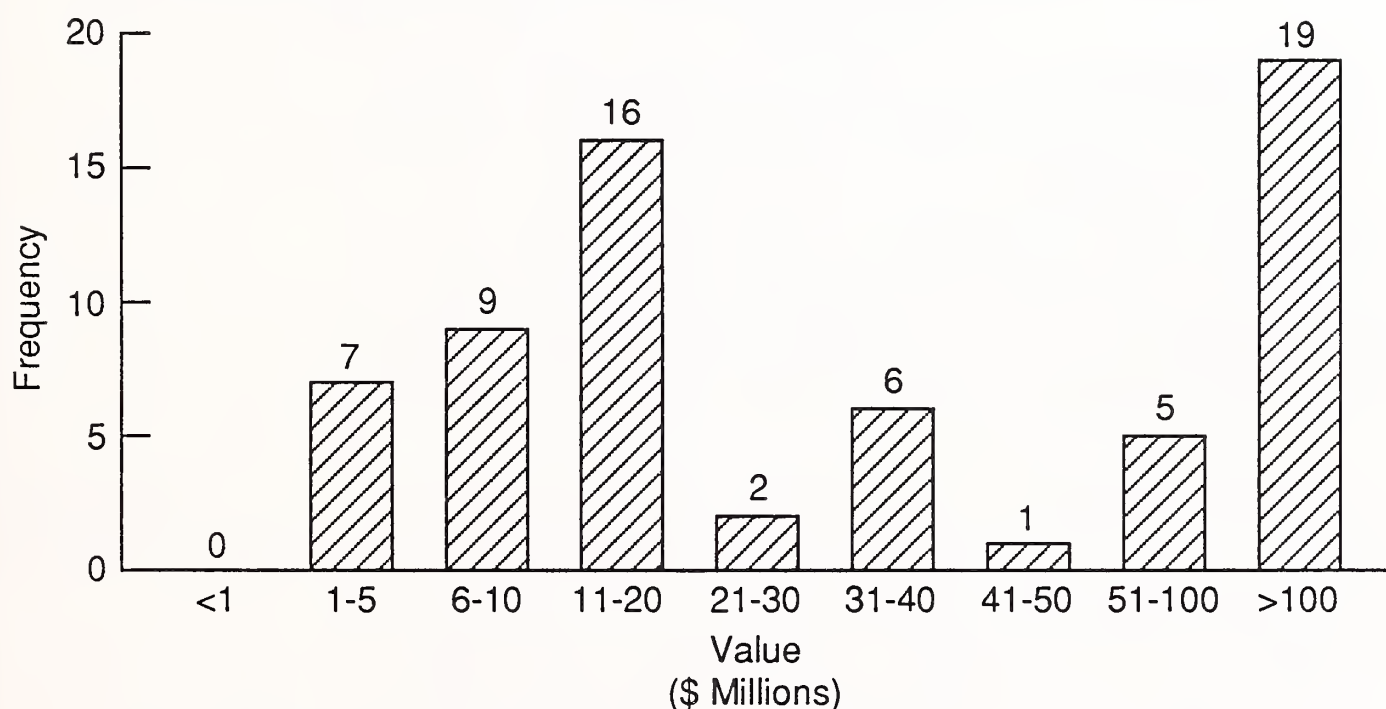


## 2. Federal SI Projects

The distribution of federal government SI projects is illustrated in Exhibit V-4. While the number of analyzed projects is slightly more than half of those in the CSI sample, the average value is higher. The midpoint in the federal sample is \$20 million, four times the commercial sample. Note also that 19 FSI projects have reported values greater than \$100 million, as compared to only five in the CSI sample.

EXHIBIT V-4

### DISTRIBUTION OF FEDERAL PROJECTS BY VALUE



Updated 12/88.

It appears that a number of the large CSI projects were unvalued or the client chose to define the value as proprietary. There have also been several in-house SI projects reputed to be high value, but split into several phases to minimize the risk.

## 3. Distribution by Industry

Of greater significance is the distribution of SI project values by vertical industry markets (see Appendix B for identification of SIC codes in each industry). State and local government, which is included in CSI by INPUT's definition of vertical markets provided the largest number of

projects, followed by banking/finance and process manufacturing, as noted in Exhibit V-5. Note that the three highest also have about half of the programs in the category of less than \$5 million. As will be seen later, most of these projects deal with a specific application or network integration.

EXHIBIT V-5

### DISTRIBUTION OF PROJECTS BY VALUE BY INDUSTRY MARKETS

	Number of Projects	Contract Value (\$ Millions)					
		<5	5-10	11-20	21-50	51-100	>100
		Percent of Total					
State and Local	27	12	4	2	6	2	1
Banking/Finance	16	9	3	1	3	-	-
Process Manufacturing	14	6	4	2	1	-	1
Insurance	11	4	4	1	1	-	1
Discrete Manufacturing	10	5	3	-	2	-	-
Retail Distribution	9	4	2	2	-	-	1
Transportation	9	4	-	2	1	1	1
Medical	9	7	-	2	-	-	-
Utilities	5	3	-	1	1	-	-
Telecommunications	2	1	-	-	1	-	-
All Other	13	2	5	2	4	-	-
Total Commercial	125	57	25	15	20	3	5
Federal	65	7	9	16	9	5	19
Total	190	64	34	31	29	8	24

Updated 12/88.

Also note that five of the commercial vertical markets in Exhibit V-5 have one project each of greater value than \$100 million. It is obvious that the governmental agencies more readily identify the value of the major projects, and have a broad distribution in values. Larger banking and finance projects above \$50 million were not identified in the current data base, but have a range of lesser projects as they improve the integration of services to customers.

The remainder of the commercial vertical market and the federal government market samples are also indicated in Exhibit V-5. The category "All Other" includes the services, wholesale distribution, education, and agriculture industry markets.

There were a number of medical industry projects for which the values were unavailable, except for the nine noted.

Slightly less than half of the commercial projects in the list of these industries were valued at less than \$5 million, and consisted of small network integration or single application integration contracts.

The distribution of federal projects emphasized the large size and multiyear nature of SI efforts in this market, and the availability of information about them. Smaller programs, under \$5 million in size, tend to be limited to specific agency networks, or integration of existing standalone systems for offices, laboratories, and small installations (in defense).

## C

### Cross-Industry Integration Markets

While many SI vendors are focusing on vertical markets as their primary strategy, it has become increasingly apparent that others are viewing the market from a horizontal or cross-industry perspective. These types of SI projects can be characterized by specialization in specific cross-industry markets, some new technology that enhances automation, or a particular level of the infrastructure. The major share of the SI Project Data base represents applications that could also be viewed as industry-specific, as noted in the preceding subsection. Almost a third of these could also be viewed as cross-industry or infrastructure integration projects. Although there are a variety of classification schemes to aid in analysis of market trends, INPUT has elected to examine these samples in two categories; cross-industry and infrastructure integration.

#### 1. Cross-Industry Market

Among the projects in the data base, a number have been awarded on the basis of a vendor's capability to develop applications which leverage a specific technology, or integrate multiple applications for a particular environment. In addition to the list of cross-industry markets employed

by INPUT in describing the information industry in the Market Analysis Program (MAP), two specific technologies, image processing and automation, have been included in this analysis, primarily because there were project examples in the data base, as noted in Exhibit V-6.

A number of other areas have been suggested for specialization: EDI, security, distributed data base, high-volume transaction processing, and voice/data integration. While INPUT believes that increasing amounts of money will be spent in these areas as part of SI projects, they did not appear in the data base. They also may not present opportunities for specialists to serve as a prime SI contractor.

EXHIBIT V-6

### DISTRIBUTION OF PROJECTS BY CROSS-INDUSTRY MARKETS

Cross-Industry	\$ Millions		
	Total Value	Average Size	Range
Office Systems	490	6.5	1.2 - 60
Engineering and Science	428	33.0	0.6 - 236
Automation	280	13.5	0.8 - 48
Accounting	68	5.2	2 - 21.5
Image Processing	54	1.4	1.5 - 7.5
Planning and Analysis	52	2.9	1.3 - 12
Education/Training	34	5.8	1.5 - 23
Human Resources	18	2.5	1.0 - 3.5



The leading cross industry appears to be office systems, which will also be identified as an infrastructure integration opportunity area. Additional projects in this area were included as part of larger applications in the vertical markets, so that specialists in this area may also pursue supporting roles with vertical niche vendors. While the average contract size is not high, there are several major efforts in the data base. This is expected to be a sustaining market in both commercial and government applications.

Engineering and science is the second largest area in the data base, and is identified with both the largest average contract size and largest single contract value. The technology content is similar in focus to automation and image processing projects. These types of contracts have been awarded on the basis of the vendor's capability to develop applications that leverage a specific technology or require the integration of multiple applications that will utilize such technology. Some integrators may be able to develop a specialty niche focused on the application of cross-industry and emerging technology areas, similar to those noted in the SIPR Data base, as illustrated in Exhibit V-7.

As could be expected, some cross-industry vendors are also associated with one or more vertical industry markets. Examples include Andersen Consulting, CSC, EDS, IBM, SHL, WANG, and by implication, DEC. Others have an established niche in a specific cross industry, such as Plexus Computer and Innovative Technologies in image processing, Harnischfeger in automation, CAMI in accounting, and Appollo in engineering and sciences.

## **2. Infrastructure Integration Market**

Based on INPUT's annual research of user executives, there is an increasing amount of pressure to develop new applications in shorter time frames. IS executives see the opportunity to shorten development cycles, if standardized environments, processing, and workstations are in place. The integration of various data and network structures with independent architectures permits the IS department to handle end-user management of applications development, enables inter-divisional systems, and produces an environment for executive decision systems. Another way to look at cross-industry SI projects is through a classification scheme based on infrastructures listed in Exhibit V-8, which estimates the value, average size, and range of this project class.

EXHIBIT V-7

### KEY COMPETITORS— CROSS-INDUSTRY INTEGRATION MARKETS

Cross-Industry	Vendors Identified in SI Project Data Base
Office Systems	SHL, Wang, CSC, AMS, IBM, MMDS
Engineering and Science	GDS, Apollo, GE, KDSI, Raytheon
Automation	Andersen Consulting, AGS/Nynex, Digital, EDS, Harnischfeger, CTG/SSS, Honeywell Bull
Accounting	Andersen Consulting, CAMI, CSC, EDS, SHL
Image Processing	AMS, Plexus Computer, Digital, IBM, Wang, CSC, Andersen Consulting, Innovative Technologies
Planning and Analysis	A. Young, Andersen Consulting, CDC, SHL, Ernst & Whinney
Education/Training	IBM, Coopers & Lybrand, SCT, CDC
Human Resources	SHL, MAXIMA

The SI market alternatives available to vendors include functioning either as a prime contractor with in-house or alliance-provided skills to cover the full range capabilities needed, or as a subcontractor in a specialty area working through alliances. Considering the low end of the contract-size range found in the SIPR Data base, there appears to be an option for developing a niche position with lower initial risk, and then applying this experience to larger projects. Except for factory infrastructure integration, the infrastructure areas apply across all vertical markets, with the possible exception of the services industry.

EXHIBIT V-8

### DISTRIBUTION OF INFRASTRUCTURE INTEGRATION PROJECTS

Integration Project Class	\$ Millions		
	Total Value	Average Size	Range
Network	850	15	0.3 -38.0
Data Base	96	10	2.5 - 12.0
Office Systems	490	6.5	1.2 - 60.0
Factory	280	13.5	0.8 - 48.0

As was noted earlier in the cross-industry comments (Exhibit V-7) there are vendors who have developed horizontal as well as vertical SI expertise. Exhibit V-9 shows, perhaps incompletely because of the data base size, that IBM, Andersen Consulting, AMS, CSC, Digital, EDS/GM, and SHL Systemhouse have the resources to address two or more areas or are addressing projects that involve two or more areas. AT&T, BCS, and U.S. West appear in the network integration area, while Harnischfeger and Bechtel were listed, as expected, for factory integration.

EXHIBIT V-9

### KEY COMPETITORS— INFRASTRUCTURE INTEGRATION

Project Class	Vendors in SI Project Data Base
Network	IBM, Digital, EDS, BCS, ATT, CSC, U.S. West
Data Base	EDS, GTE, SHL, Andersen Consulting, DBMS
Office Systems	SHL, Wang, CSC, AMS, IBM
Factory	Harnischfeger, Digital, IBM, Bechtel, AMS, Andersen Consulting



These projects offer some unique opportunities for several reasons. Hardware vendors would find the emphasis on technology more credible than requiring highly specific industry expertise. These projects have a high dollar component of hardware and software, with prospects of higher margins than the professional services content. In addition, high level project management are not as critical for data and network projects.

Overall, the idea of specializing in certain classes of cross-industry and infrastructure integration may be particularly attractive to vendors with the requisite resources and orientation. Opportunities in these specialties appear to be growing at a rate comparable to the vertical industries. Further, these projects are frequently awarded by IS executives who could be the primary contact point for this class of SI vendors.

## D

### Distribution of Expenditures by Component

Another aspect of SI awards includes the distribution of expenditures by component groups of: hardware (computer and communications), professional services (custom software development, design, consulting, program management, education and training, integration, and, where used, operations support), packaged software, and other services (processing, network, installation, engineering).

#### 1. Commercial Project Sample

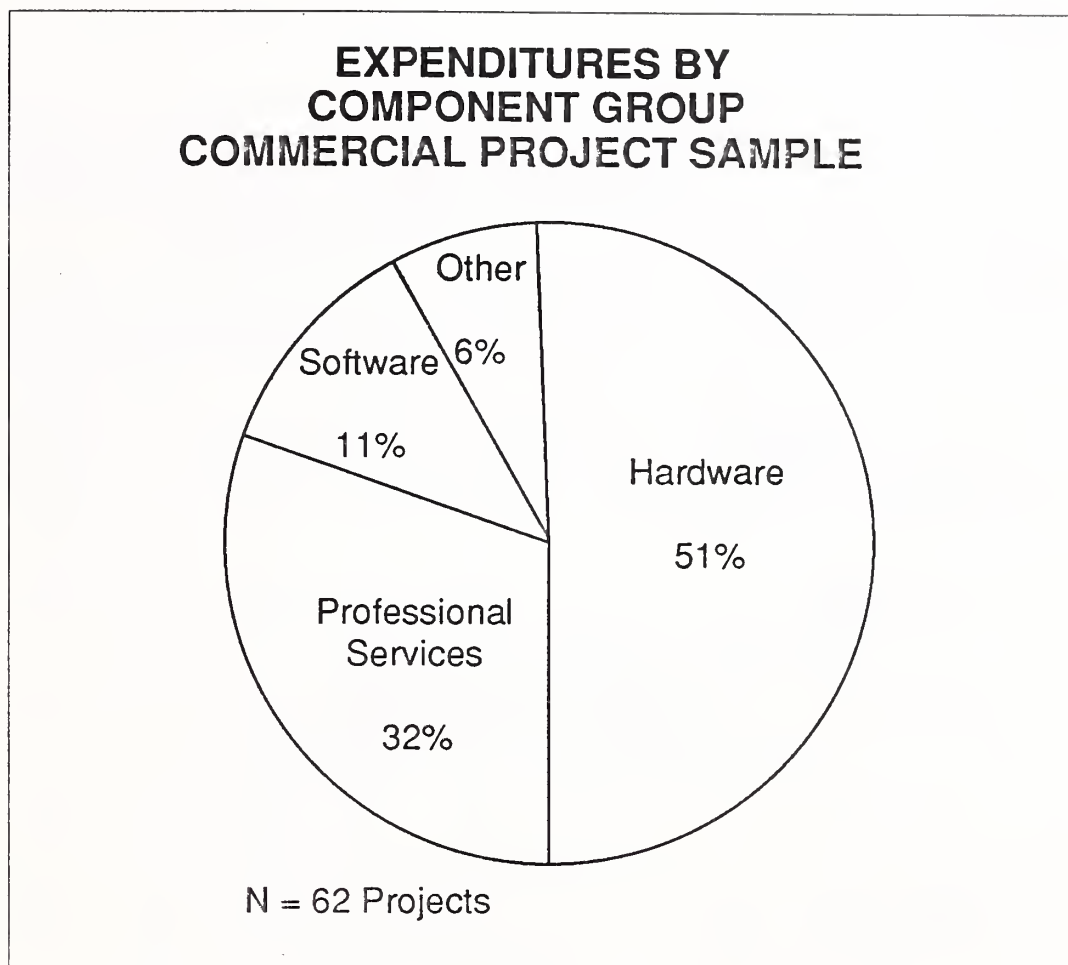
The diagram in Exhibit V-10 indicates the distribution of the sample of 62 commercial projects that were identified in sufficient detail to perform this analysis. Note that the leading component of the sample is hardware, followed by professional services, which is similar to, but not identical to, the model in Section III - Market Analysis.

Earlier analysis of the components with fewer projects in the sample, produced lower percentages of hardware and professional services, and a substantially higher number of other services. While the sample is approaching the distribution estimated for the entire CSI market, it is still affected by some hardware-emphasized projects, especially in the state and local government industry. The FSI market, as will be seen later, has demonstrated a fairly consistent distribution of component expenditures.

Because there is considerable variation between industry markets, the projects were sorted by industry to produce Exhibit V-11. The SI projects in the sample for transportation, retail distribution, discrete manufacturing, and medical industries show a proportionally larger amount of computer/communications hardware, with emphasis on communications



EXHIBIT V-10



and new mid-range computers. The banking/finance and services industries show higher than average requirements for CSI professional services, principally for custom software development, education, and training. The latter has become a continuing requirement as a result of higher employee turnover rates, and mergers and acquisitions involving dissimilar information systems. The software development efforts are also focused on resolving incompatibilities between merged systems.

The lower than average hardware investment in the services sector is partly due to increasing use of small computers and continued employment of existing hardware. The banking/finance and insurance industries have maintained a continuing program of hardware improvement, so that much of the hardware component of the sample SI projects was limited primarily to communications and some special-application minicomputer and intelligent workstation hardware.

The low levels of transportation and retail distribution utilization of professional services are reflections of the high hardware content of the sample projects, and may be anomalies that will be resolved as more projects are analyzed. The two projects analyzed in the telecommunications industry sector really constitute too small a sample from which to draw any meaningful conclusions.

## EXHIBIT V-11

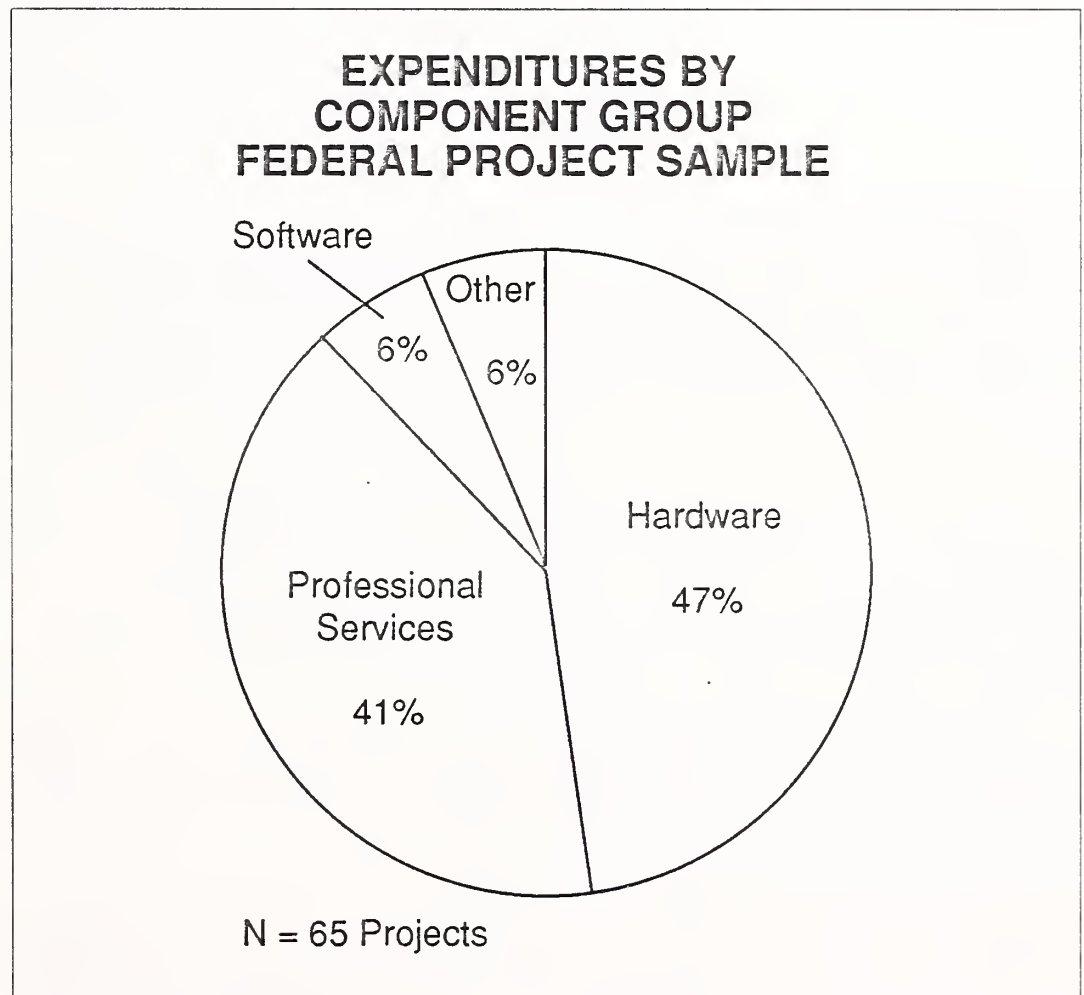
**EXPENDITURES BY COMPONENT GROUP  
COMMERCIAL PROJECT SAMPLE  
BY INDUSTRY**

Industry	Average Percent of Project			
	Hardware	Software	Professional Services	Other
Banking/Finance	20	10	67	3
Discrete Manufacturing	63	10	23	4
Insurance	27	15	43	15
Medical	63	10	23	4
Process Manufacturing	32	8	49	11
Retail Distribution	85	7	8	-
Services	5	10	85	-
State and Local Government	38	9	35	18
Telecommunications	35	42	23	-
Transportation	87	8	5	-
Utilities	50	-	46	4
Wholesale Distribution	40	8	44	8

## 2. Federal Project Sample

As noted earlier, the distribution of component expenditures in the federal market are more consistent with the major project orientation of the government, as seen in Exhibit V-12. Many of the projects analyzed are total replacements for existing third-generation systems that lack capacity, speed, and flexibility to meet emerging information, data processing, and control functions. Although GAO, GSA, and OMB have continued to emphasize the desirability of moving more forcibly into packaged software, there are a number of uniquely governmental functions involved, that have no commercial counterpart. Applications in the FAA, IRS, NASA, SEC, and HUD are illustrative of the need for fairly heavy investments in software development, interface design, and post-implementation FM.

EXHIBIT V-12



There are also some unique defense projects involving logistics, engineering, and information processing that require substantial software conversion and development of custom software. The presence of very large data files and the continuing proliferation of PCs in these agencies impose a variety of constraints, including the design of open-ended

systems to accommodate planned future additions. Analysis of the federal SI market characteristics have been included in this report for a number of reasons. This market has employed the SI disciplines longer, has a somewhat more mature hardware inventory, and is heavily burdened by maintenance of old custom-developed software.

## E

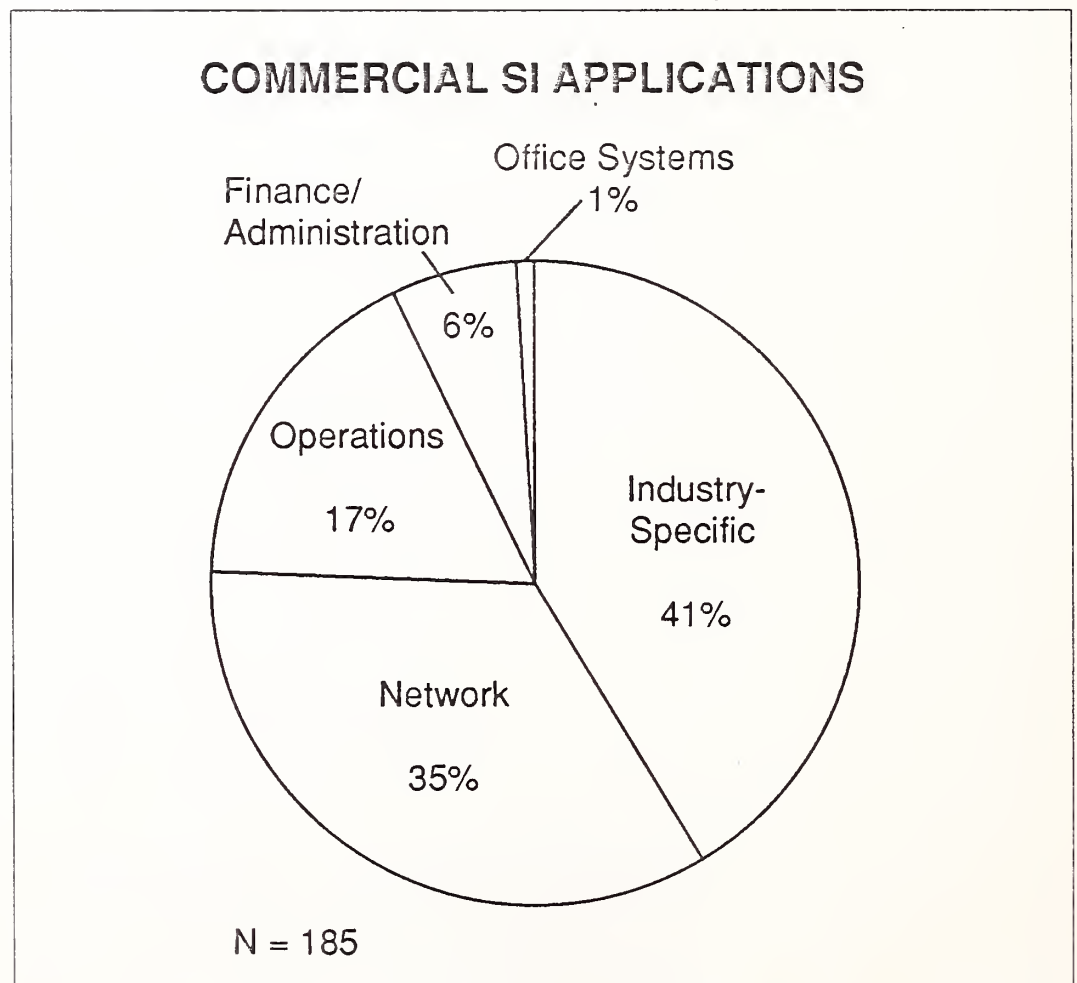
### SI Project Applications

The project data base was also analyzed for the primary application of the SI projects to determine which areas were being emphasized.

#### 1. Commercial Applications

The largest applications area, 41% of the commercial projects, was oriented to meeting industry-specific needs as noted in Exhibit V-13. The sample includes projects for which there was insufficient information to define SI project component distribution. Examples include a banking application for Chase Manhattan Bank (\$25 million), an energy management system for Omaha Power (\$5 million), an MRP system for Sterling Drug (\$10 million), and an integrated court system for Allen County, PA (\$6.5 million).

EXHIBIT V-13





Network applications appeared as the second largest area, represented in 35% of the projects analyzed. Typical projects include a remote store communication network for F.W. Woolworth (\$1.5 million), a dealer communication network for Porsche Cars N.A. (\$3.5 million), a corporate SNA network for United Airlines (\$63 million), and a data communications network for Pennsylvania (\$21.6 million). Operations applications were involved in 17% of the projects, as typified by a computer-aided dispatch police system for Austin, TX (\$1.7 million) and a data center consolidation for USS/POSSCO (\$25 million).

Finance/administration applications account for six percent of the CSI sample. Projects included the Phase I Administration System for the Houston (TX) Community College (\$6 million), a direct billing system for Royal Insurance of America (\$10 million), and a materials and purchasing system for ARCO-Alaska (\$20 million). Most office systems projects were small, like the project for the Aircraft Owners Association (\$1.2 million).

## **2. Federal Applications**

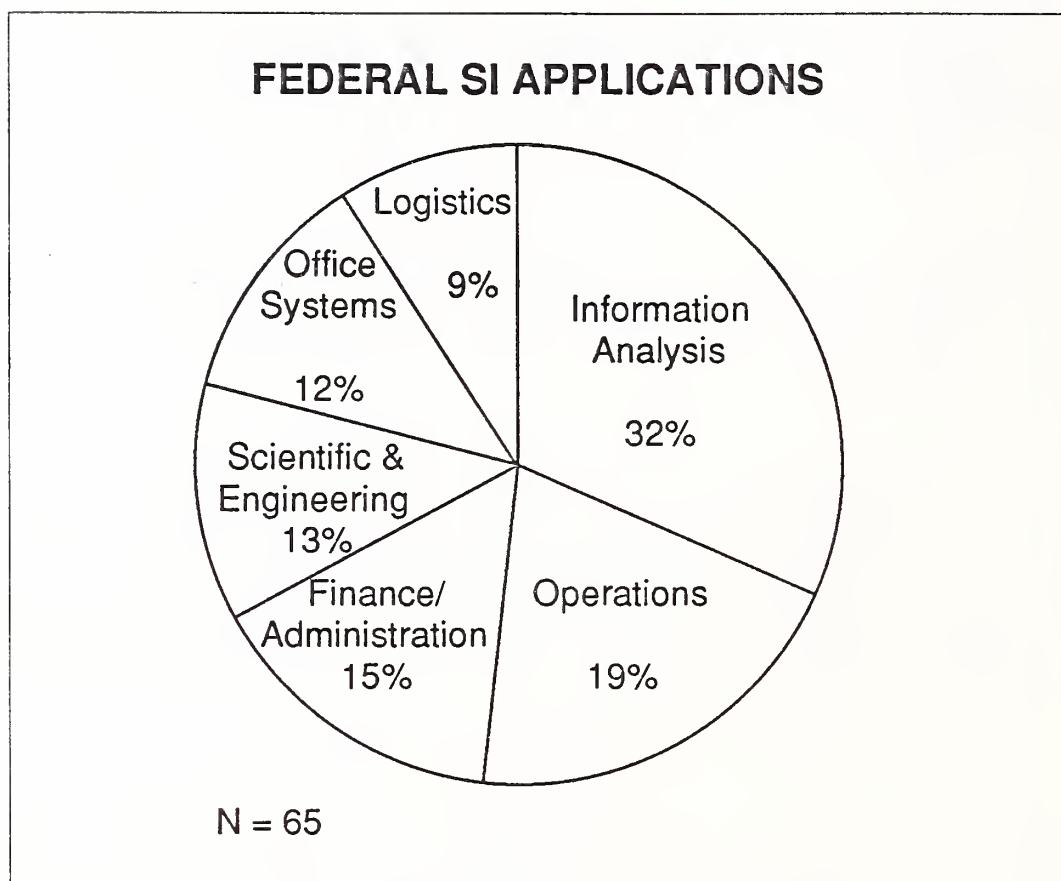
The FSI applications segmentation is more granular than CSI, but a combination somewhat similar to CSI is shown in Exhibit V-14. The combination of federal agency-specific applications (logistics, information analysis, and scientific and engineering) represents 54% of the 65 projects in the data base, with a reasonable correlation to the distribution discussed in the recent update of INPUT's *Federal Systems Integration Market* report.

The largest subsegment, information analysis, includes programs for Social Security Administration, SEC, Labor, and Immigration and Naturalization Service. Scientific and engineering projects are being implemented for NASA, Commerce, NOAA, and Air Force Laboratories.

Office systems programs are larger and more extensive in the federal sector, as agencies update and integrate multiple levels and types of equipment. Many of these projects include LANs and WANs to interconnect widely distributed offices and branches.

Finance/administration systems have been given new attention under the Administration's REFORM 88 Program, with a single financial system to be implemented by 1992 and major replacements scheduled for defense and civil agency human resources and payroll systems. Operations systems are being implemented for the IRS, HUD, GSA, Transportation, and the Postal Service. More of these projects are expected to be authorized over the next five years.

EXHIBIT V-14



## F

Project Focus  
Classification

A definition of systems integration that satisfies both vendors and clients seems to elude the industry. Clients have tended to use the term "integration" principally for outside contracts, while they prefer to describe in-house efforts as "modernization" or "replacement" projects. The definition applied by vendors depends on the primary focus of the firm and the extent of project responsibility. Except for some very definitive projects, there has been no common ground for classifying and measuring SI projects.

The project-tracking service, instituted by INPUT for producing Systems Integration Project Reports (SIPR) for the Systems Integration Planning Service, needed some refinements that would assist in project analysis. A classification method was needed to identify key relationships, examine technology requirements, and note the strategies employed to meet them. The characteristics generally associated with SI projects, such as mission critical, complexity, and multidiscipline nature, did not seem to provide sufficient differentiation between projects.

## 1. Evolution of the Classification Framework

During the INPUT SI workshops in 1988, a project classification and tracking methodology evolved through the interchange of ideas with program clients. An analytical model was described that would aid in understanding the fundamental relationships between classes of projects and vendor capabilities. The original model developed during the 1987 investigation of selected SI implementations divided the projects into three classes: applications, data, and networks.

The limitations of these rather narrowly defined classes became apparent when the workshop attendees were unable to include projects within the model associated with technological improvements such as process automation/EDI/imaging, and post-implementation support.

It was determined that redefined classifications would permit use of "project focus" as the key parameter. The change between the earlier and latest classification levels are as indicated:

### Classification Levels

Old	New
Applications	<i>Applications and Process</i>
Data	<i>Data and Infrastructure</i>
Networks	<i>Networks and Technology</i>
(None)	<i>Support</i>

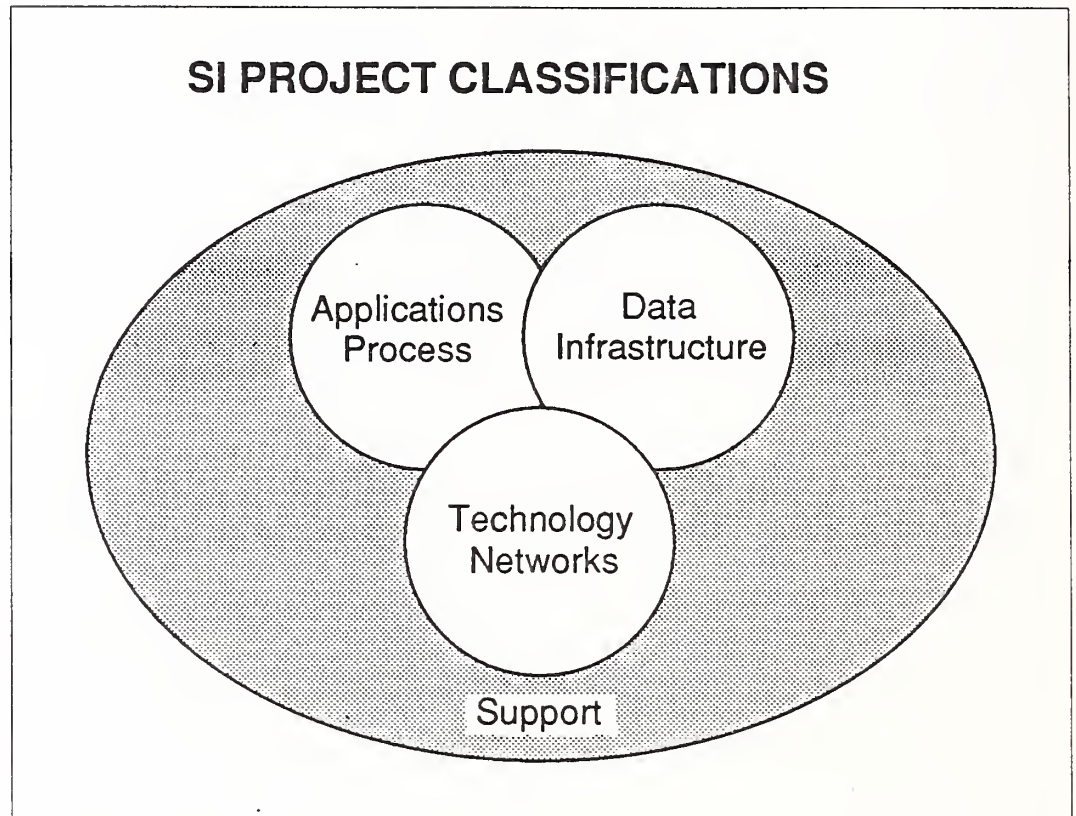
The relationship between classification levels is illustrated in Exhibit V-15, including the overlapping levels in some projects that address two or more problems. Support, as a focus parameter, is present in many of the SI projects, certainly during the implementation phase and often following to acceptance by the client, for training, maintenance, or systems operations.

Within the limited range of projects in the data base, the classification model has been tested to assess its usefulness in terms of understanding the market trends, examining critical technology requirements, and evaluating the effectiveness and need for alliances. The model did not produce sufficient information to analyze vendor strategies.

The analytical model does enable categorization of vendors and relates them to the project classification levels. These relationships will be illustrated shortly.



EXHIBIT V-15



## 2. Applications/Process-Focused Projects

The programs that fit into this level are focused on specific business solutions that support the line of business, including administration, accounting, sales, production, etc. The solution is driven by the client's executives and/or its user management, usually identified with operations or the key process around which the organization functions. A number of projects on this level are designed to offer short-term payout, with high visibility of both the process and results.

The dominant vendor classes at this level are professional service and software supply firms, as noted in Exhibit V-16. Typical vendors include Andersen Consulting, CSC, American Management Systems, BIS Banking Systems, and Health Data Sciences. A key characteristic of these vendors is the presence on their staff or accessible through consultancy of "subject specialists" who are closely coupled by experience and training with the specific operation being supported.

The critical technologies emphasize project management methodology, CASE tools, and development of applications shells that make the process more user oriented and less dependent on IS skills to use the system. PM methodology assures greater compliance of the solution to the operations or corporate problem.



## EXHIBIT V-16

## APPLICATIONS/PROCESS-FOCUSED SI PROJECTS

Dominant vendor classes:	57%—Professional services 13%—Turnkey systems
Critical technologies:	Project management technology  CASE tools  Applications shells
Primary alliances:	Applications software companies  Systems software companies
Secondary alliances:	Hardware companies  Telecommunications companies

Primary alliances in applications-focused SI projects would include both systems and applications software. Typical vendors with declared SI interests include Oracle, Cincom, Pansophic, Metier, Systems Unlimited, and Hogan Systems. Some vendors, like Andersen Consulting, Syscon, and AMS have developed software packages that directly apply to the targeted vertical markets. Others, like EDS/GM, PRC/Emhart, SHL Systemhouse, and SAIC would prefer to use partners to provide off-the-shelf packages that have been demonstrated on the appropriate platforms. Typical secondary hardware alliances are NCR, Prime, HP, and Unisys, along with telecommunications companies like Northern Telecom, Mitel, GTE, or Doles Network.

### 3. Data/Infrastructure-Focused Projects

Projects in this classification address requirements of modernization, major expansion, and replacement of the data infrastructure of the client. Major concerns at this level are associated with establishing inter-system compatibility, software portability for both end users and data centers, data integrity, and substantially enhanced transaction speed/volume capability.

The key players in the client environment tend to be IS divisions or IS subsidiary management. The programs provide the platforms for suites of applications required by executive management, finance operations, and business controls. The principal characteristics of this level are listed in Exhibit V-17.

EXHIBIT V-17

<b>DATA/INFRASTRUCTURE-FOCUSED SI PROJECTS</b>	
Dominant vendor classes:	80%—Professional services
Critical technologies:	Data analysis/design tools
	Conventional and relational DB software
Primary alliances:	Applications software companies
Secondary alliances:	Hardware companies
	Telecommunications companies

Professional services firms are the dominant vendor class here, playing a significantly larger role than in applications/process-focused projects. Vendors that are prominent in this level range from CSC, EDS/GM, PRC/Emhart and SAIC, to SHL Systemhouse and Systematics, to CTG, SCT and CDSI. These companies are specialists in the critical technologies of data analysis and design tools.

Data base systems have been an important technology in the corporate data centers, as well as those supporting interdivisional and outside information processing. Where file systems have become overloaded, cumbersome, or unavailable on-line, the newer systems are moving to relational DB software. The latter also broadens support to an increasing number of PC-equipped managers.

Applications and DB software companies are the primary alliances candidates, because their products are essential to meeting these emerging business data needs. Oracle, Cincom, ADR, Cullinet, and some industry-specific software firms play key roles at this level. And, as noted in the applications level, hardware companies, notably IBM, DEC, CDC, Unisys, and the leading PC suppliers, with proven operating software, are key to success. The telecommunications companies, including AT&T, Contel, GTE, and several of the RBOCs, are important secondary allies in this level.

#### **4. Technology/Networks-Focused Projects**

This level has really two channels, technology insertion and networking, aimed at providing or enhancing the delivery capability in a project. With the move to consolidating communications and information processing under a single manager, these projects tend to be driven by the IS staff. Technology insertion may focus on operations improvements, or improving information flow among and through key data centers. Clients moving to new levels of information employment look to projects in this level to provide a standard environment, to enhance reliability, and to provide a base for using newer productivity tools.

Unlike the two preceding levels, communications providers and hardware manufacturers play a dominant role, at times competing for the services of industry-specific software and systems suppliers as noted in Exhibit V-18. Key players in the SI Data Base include AT&T, Hughes Network, Telenet, and U.S. West among the communications firms, and Digital, Honeywell-Bull, IBM, NCR, Plexus Computers, and Unisys among the hardware organizations.

Similar to data/infrastructure-focused projects, design tools are critical, and are used to develop networks and interfaces to new technologies. Communications hardware and software that is uniquely adopted to network management, automated process and production equipment, and other advanced technologies are also critical to a number of projects at this level.

Suppliers of communications, software and hardware, are primary allies to professional services and systems suppliers for this SI project classification. Examples of firms identified with this level include CONTEL, AT&T, GTE, Mitel, Pacific Telesis, and Northern Telecom.

## EXHIBIT V-18

## TECHNOLOGY/NETWORKS-FOCUSED SI PROJECTS

Dominant vendor classes:	27%—Communications providers 27%—Systems suppliers 20%—Professional services
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Critical technologies:	Network design tools
------------------------	----------------------

Communications software and hardware

Computing

Primary alliances:	Communications companies
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Software supplier companies

Hardware manufacturers

Secondary alliances:	Professional services companies
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If a communications provider or systems supplier bids in this classification, professional services companies with vertical industry credentials can be extremely important to winning, especially against firms like CSC, EDS/GM, Andersen Consulting and PRC/Emhart, who have developed or acquired telecommunications network design and implementation skills and resources. Examples in the SI Project Data Base include these same companies.

### 5. Support Level Projects

The support level is not really an independent classification, but rather additional capabilities that may be attached to any of the other levels. Major capabilities are provision of services and products to satisfy maintenance alone, operation and maintenance, or systems operation (facilities management) in the post-implementation period. Additional services that can be included are training, system scheduling, and minor systems updates or expansion.



At present, professional services firms are the dominant vendor class and aerospace firms are second. Both are supplemented by service personnel from the hardware and communications suppliers, and some on-call support from the packaged software supplier. Key vendors in the current market include BCS, CSC, EDS/GM, PRC/Emhart, SAIC, and SHL Systemhouse. Hardware vendors are giving serious consideration to expanding their offerings in the support level.

## 6. Distribution of Projects by Focus

Analysis of the SIPR Data Base from the perspective of this project classification scheme provides still another snapshot of the market place. In Exhibit V-19, both the number of projects and the combined value of contracts in each class are displayed.

EXHIBIT V-19

DISTRIBUTION OF PROJECTS BY FOCUS		
Focus	Percent of Sample	
	Value	Number
Applications	18	31
Data	42	23
Technology	13	17
Networks	27	29
Total	100	100

The data shows a degree of correlation of the technology and networks samples in their relative share of the data base. The difference between the value and number of projects provides some insight to the average contract size. Although more numerous, applications-focused projects tend to be smaller in the range of \$1 million-\$5 million, at least in the sample of the data base, mainly because they tend to be limited to a fairly specific business function. The vendors are most likely to be Big Eight, professional services firms, and some of the aerospace companies. The data-focused projects are much larger, with the average in the \$6 million-\$10 million range, with higher hardware and professional services content than the other three. The dominant vendors tend to be hardware companies, as noted earlier.

The distribution of projects by vertical markets was also examined, to see what trends might become apparent. Exhibit V-20 displays this distribution. Network-focused projects are slightly ahead of applications, driven particularly by banking/finance, state and local government and all other (education). These three vertical markets include organizations that need networks for both voice and data to enhance connectivity between geographically dispersed facilities, and, in the financial market, inter-connection with related institutions, both domestic and international. The trend is expected to continue near term.

Applications-focused projects occur frequently in the state and local government and utilities markets, and have good representation in transportation, insurance and banking. The projects emphasize integration of previously separate or semi-automated functions. While the projects are smaller, they are fairly numerous and INPUT feels that opportunities in this project area will increase in both size and frequency, to meet rising demand for rapid and quality response to customers or the served public.

As expected, the technology-focused projects appear more frequently in the manufacturing markets. The narrow margins and high cost of storing both raw materials and processed products are pushing manufacturers into automation and MRP/MRP II implementation. The growth rate of SI implementation needs to increase, if the firms in these verticals expect to survive rising labor and transportation costs, as well as overseas competition. The Department of Commerce forecast of \$465 billion in capital investment in 1989 supports prospects of growth through the early 1990's.

Data-focused projects are present in the data base for most of the vertical markets. Comments about infrastructure integration were made earlier in this section. Integrated data centers and applications platforms are seen as essential to IS executives who are faced with meeting increasing user application demands and the need for executive support systems. INPUT forecasts continued growth of data-focused opportunities in both vertical and cross industry markets. Vendors who are vertical-industry oriented will need these skills, either in-house, or through alliances.

## G

### Competition

An analysis of both the complete and incomplete projects in the SIP Data Base also provides some interesting insights into the types of SI vendors. While the data base is only a sample of the total marketplace, the projects have a total value of approximately \$1.5 billion, or roughly one-third of the volume of projects for 1988. Some vendors that are actually doing well in the SI market may have been missed, partly because the SI buyers chose to not identify the prime contractor, and partly because a number of projects were not discovered during the sweep of the Business Week 1,000 and Fortune 1,000 top firms in the U.S.

## EXHIBIT V-20

### DISTRIBUTION OF PROJECTS BY FOCUS BY INDUSTRY

Vertical Industry	Number of Projects			
	Applications	Data	Technology	Networks
Banking/Finance	4	3	2	7
Discrete Manufacturing	2	2	4	2
Insurance	4	5	1	1
Medical	1	3	2	3
Process Manufacturing	1	3	9	1
Retail Distribution	1	3	1	4
Services	1	3	-	2
State and Local Government	10	7	3	7
Telecommunications	1	1	-	-
Transportation	4	2	-	4
Utilities	4	1	-	-
All Other	3	-	-	6
Total	36	33	22	37

The data base and the surveys of vertical-industry and cross-industry markets described in Section IV will be discussed here. The first cut will describe the distribution of market shares by vendor class from the data base. Vendors will also be identified by vertical industry markets. Specific analyses of the leading vendors will appear in the separate SIP report, *Systems Integration Competitive Analysis*.

### 1. Market Share by Competitor Class

INPUT has reported on market shares in earlier commercial and federal systems integration reports, and at the SI workshops in 1988. In the forecasts, INPUT has estimated the distribution of the market based on performance of selected leading vendors. Exhibit V-21 displays the portions of the projects in the SI Project Data base in the federal, and commercial markets, and overall, by six general classes of vendors by their primary business focus. Firms in each class will be identified later in this section.

EXHIBIT V-21

#### MARKET SHARE BY CLASS OF COMPETITION, 1988

Vendor Class	Percent		
	Federal	Commercial	Overall
Hardware Manufacturers	20	21	20
Communication Vendors	3	10	7
Professional Services	53	32	42
Management Consultants	3	10	7
Aerospace	16	11	14
Other	5	16	10
Total	100	100	100



Although the overall market shares described in Section III identify hardware manufacturers as the leading group, the data base indicates that professional services firms led in both the federal and commercial markets, and, therefore, in the overall proportion of the market. The principal explanation for the lower percentages of both hardware and Big Eight firms was the lack of information on contracts awarded in protected accounts, or in some critical level of negotiations. It also indicates the importance of customer contract to these classes of vendors. The variety of SI projects being implemented by IBM, DEC, NCR, and WANG is known to be greater than reflected in the reported projects. Similarly, the Big Eight firms were unable to identify a number of client SI projects under their clients' confidentiality agreements.

The aerospace firms have been only partially distracted from their prime market by SI opportunities, despite the amount of expert resource available in-house. INPUT expects them to focus on increased participation as the growth of the defense market begins to decline and commercial aircraft sales level off. Communication vendors are finding considerable competition from professional services companies for network integration contracts. A number of them expect to move into the information services industry through internal growth and/or acquisition of highly skilled systems integration firms that are already well positioned in the marketplace.

The "other" class includes a variety of engineering, automation, and specific industry service firms that have developed or split off their systems integration staffs to operate in a specialized industry niche. They have garnered the third largest share of the commercial projects in the data base. These companies could become excellent allies for cross-industry vendors looking for a way into a vertical industry market.

## **2. Vendors in the Competitor Classes**

It should be evident that there are other firms in the classes described above that are doing business in the SI market. The list shown in Exhibit V-22 is therefore representative. INPUT believes it has included the known leaders, as well as, firms advertising significant SI capability(ies) on this list. As noted, those tagged by an asterisk were identified with one or more projects in the current data base.

The hardware manufacturers include IBM, the bunch, and some smaller firms. These firms have frequently installed small to large mainframes with both application and system software and established niche markets. Initially, when the client indicated the need for extensive custom software, or the integration of two or more makes of ADP equipment, these hardware vendors tended to team with a suitable professional services firm. As the hardware component declines in terms of project cost,

## EXHIBIT V-22

**SI VENDORS BY COMPETITOR CLASS**

Class	Vendors
Hardware Manufacturers	*CDC, Data General, *Digital, Honeywell-Bull, Hewlett-Packard, *IBM, *NCR, *Nixdorf, Prime, *Harris, Unisys, *Wang, *Plexus
Communication Vendors	*AT&T, BBN, *Doles Networks, *GTE, *Contel, *Illinois Bell, Mitel, Northern Telecom, Nynex, *Pactel, ROLM, *Telenet, *U.S. West, *Volt Telecom, *Ameritech
Professional Services	*ADP, AMS, *AGS, ATI, BDM/Ford Aero, C3, *CACI, *CDSI, *CSC, *CTG, *EDS/GM, Index Systems/CSC, Informix, Intermetrics, Information Systems Inc., Integrated Technical Group/First Capital, KDSI, *Keystone Information Systems, *Health Data Sciences, *Lab Force, Logicon, *MAXIMA, Metier, *MILTOPE, PRC/Emhart, *SAIC, *SCT, *SEI, *SHL Systemhouse, SMJ, Shared Medical Systems, SSA, SYSCON, *Systematics, *System One Technology, SYTEK, *Systems Unlimited, *Sterling Software, *Network Solutions
"Big 8"/ Management Consultants	*Andersen Consulting, A.D. Little, *A. Young, Booz Allen Hamilton, *Coopers & Lybrand, Deloitte Haskins & Sells, Ernst & Whinney, *Marshall & Isley, McKinsey, Peat Marwick & Main, PMS, *Price Waterhouse
Aerospace	*Boeing, General Dynamics, Grumman Data Systems, Ford Aero, *Hughes/GM, Lockheed, Litton, *McDonnell Douglas, Martin Marietta
Others	*Atlantic Research Corp., AVIS Information Systems, Bechtel, *Brock Control, CyCare, *Equifax, Federal Engineering, Inc., Fluor, Foxboro, *Harnischfeger, Integrated Automation, Innovative Teletronics, Information Systems/Weyerhaeuser, *Oil Systems, *Quotron, Seqwa, Siecor, SSA, Strategic Information Services/Pennzoil, Technical Services/J.Deere, *TRW

primarily because of the continued reduction in cost per MIP, these vendors are expected to add to their in-house professional service staffs to increase their prime contractor role and revenue.

Communications vendors are expected to increase their participation beyond network integration, to include platform and infrastructure integration. More of the RBOCs, like Bell South and Bell Atlantic, as well as the larger BOCs, appear to be improving their prospects by acquisition of medium-sized professional service firms with established SI market position (i.e., NYNEX's acquisition of AGS) or through alliances like Ameritech and SHL Systemhouse.

Professional services firms are by far the most numerous in the marketplace, with varying degrees of penetration. Several of these have been acquired by large corporations not directly associated with information systems and services, such as General Motors and Emhart. First Capital is one of several non-vendor institutions that spun off their internal systems integration staff, to employ their specific industry knowledge to perform similar projects for organizations like their parent. There are also a number of smaller specialist firms who have either a niche or cross-industry capability to sell to a client or a larger SI vendor.

The professional services value-added component is forecasted to increase over the next five years, but at varying rates per individual industry market. Since only a few firms in this class could be described as having "deep pockets," the expectation is that commercial projects will tend to remain smaller, on the average, to minimize the risk for both client and vendor.

Some of the "Big Eight" and management consulting firms have leveraged their commercial/industrial knowledge to become leading integrators. Arthur Andersen has led the pack with substantial investments in a professional SI staff and a demonstration facility. The others have also moved more aggressively in the SI project direction in the past two years. New comers like Saatchi Consulting and The Information Systems Group will increase the competitiveness within this class and with those described as professional services firms.

The aerospace vendors have been high density users of computers and communications, but only a few companies placed their facilities in a standalone division and charged it with paying its own way. Grumman and Martin Marietta have had varying levels of success; GDS was quite successful in 1988. With the expected decline in defense system expenditures, it is expected that all of the aerospace firms will look to opportunities in both the federal and state government agency markets, as well as at commercial prospects.



There are quite a variety of vendors in the "other" class. Key among the vendors now, and to be expected in the future, are the automation, production, and specialized technology firms. Engineering and construction firms, with extensive practical and data processing experience, and who are used to working on high-value projects, are finding the SI market quite attractive. They have unique industry exposure that supports their prospecting and marketing efforts. Some industrial firms, like John Deere, Firestone, and Weyerhaeuser, that assembled highly skilled professional teams to handle massive new systems installations, have spun these staffs off, just as the aerospace firms, to independently address the SI market.

### 3. Vendors in Vertical-Industry Markets

In the previous exhibit (V-22) the identified SI vendors were defined by their prime industrial/commercial focus. In this segment, vendor identification will be limited to those in the SI Project Data base, and listed by vertical industry. For those with specific industry focus, the list will note a number of the current players. Since the list is lengthy, it has been divided into two exhibits, V-23 and V-24.

Banking and finance, and state and local government provided the largest number of projects and the greatest variety of competitors as seen in Exhibit V-23. It is also notable that several SI vendors are functioning in a number of industries; Andersen Consulting, AT&T, CSC, EDS/GM, IBM, and SHL Systemhouse have multiple industry appearances. Their strategy involves continued expansion of SI projects, which provide higher margins than standalone professional services. IBM and AT&T have adequate resources to address this wide range of industries and, through necessity are providing this coverage to both service and protect their broad customer bases.

The growth potential of banking and finance is highly dependent on a fragile balance of trade, inflation, and international monetary affairs. The industry will be driven by continuing competition and new services to attract customers.

Discrete manufacturing, also influenced by financial considerations, including low margins, is looking to the plant floor for solutions, increasing information-based automation to meet market demand. Specialized production-oriented firms with useful technological solutions can satisfy the industry's needs, if the proposed capital investments take place. Many of the same vendors are also observed in the process manufacturing industry, although there are some marked differences in the production methodology.



## EXHIBIT V-23

**SI VENDORS BY INDUSTRY MARKETS**

Industry	Vendors
Banking/Finance	ADP, AMS, Andersen Consulting, AT&T, Automated Information Processing, CDC, CSC, Coopers & Lybrand, Doles Network, EDS/GM, Equifax, Hughes Net/GM, IBM, Marshall & Isley, Plexus Computers, Quotron, SCT, Software Alternatives, Systematics, Telenet, UCS
Discrete Manufacturing	ATI, AT&T, Andersen Consulting, BCS, Brock Control, CACI, CTG/SSS, Digital, Harneschfeger, Honeywell-Bull, IBM, SHL Systemhouse, Siecor, Systems Unlimited, SEI, Tech Services (Deere)
Insurance	Andersen Consulting, AMC, Atlantic-Research, Coopers & Lybrand, CSC, EDS/GM, Equifax, IBM Policy Management Systems, Software Alternatives
Medical	Advanced Graphics, Coopers & Lybrand, Cycare, HBO, Health Data Systems, IBM, EDS/GM, KDSI, Lab Force, Mediflex, Maxima, McDonnell Douglas, SAIC, SMS, Sytek, Telesciences
Process Manufacturing	Andersen Consulting, Contel, Coopers & Lybrand, CTG, Digital, DHS, Ernst & Whinney, EDS/GM, Foxboro, Harneschfeger, Honeywell-Bull, IBM, Oil Systems, SHL Systemhouse
Retail Distribution	AT&T, Arthur Young, CACI, CSC, EDS/GM, IBM, Illinois Bell, Hughes Net/GM, NCR, SHL Systemhouse, Strategic Information Services (Pennzoil)
Services	Anasazic Corp., IBM, Hughes/GM, Price Waterhouse, SEI, SHL Systemhouse

The medical industry has a number of special requirements, and a host of outside influences. The mix of vendors is different and the majority of projects are small in size. Bottom-line ability to hold costs down to a respectable growth rate appears to be a major criterion for vendor selection.

Retail distribution vendors are quite different, except for EDS/GM and IBM, from those in wholesale distribution. Both appear to attract spin offs from companies that function in the industry.

State and local government SI opportunities are not widely advertised, which works to the advantage of local bidders and those national vendors with extensive sales and service networks. Some specific industry experience also helps to provide for better market visibility if the projects meet client expectations. At present, the project emphasis appears to focus on state, metropolitan centers, and densely populated counties. Cross-industry specialists, as shown in Exhibit V-24, should find a variety of project prospects in this market in the next four years.

EXHIBIT V-24

### SI VENDORS BY INDUSTRY MARKETS

Industry	Vendors
State and Local Government	Andersen Consulting, Arthur Young, AGS/Nynex, AMS, AT&T, Ameritech, BCS, Coopers & Lybrand, CSC, EDS/GM, FDR, FEI, GTE, IBM, Keystone Information Systems, McDonnell Douglas, NCR, Nixdorf Computers, PRC/Emhart, Price Waterhouse, PacBell, SCT, SHL Systemhouse, Unisys, Wang
Telecommunications	Andersen Consulting, BBN, CSC, EDS/GM, Unisys, U.S. West
Transportation	Andersen Consulting, Contel, EDS/GM, IBM, PST, Unisys, System One Technology
Utilities	Bechtel, CDC, EDS/GM, IBM, Martin Marietta, Systems Unlimited, Telenet, TRW
Wholesale Distribution	Digital, EDS/GM, Innovative Teletronics, IBM, Information Systems/Weyerhaeuser
Other	AT&T, BCS, Coopers & Lybrand, IBM, SCT, UCS

The telecommunications industry is attractive for non-communications firms, like Anderson Consulting, CSC, EDS/GM, and Unisys, because they are not viewed as competitors, and have been used successfully as partners in other industry opportunities.

Utility companies are prone to use of SI vendors with specific industry experience. Martin Marietta and CDC have Energy Divisions created during the 1970s to address alternate energy sources, and are equally knowledgeable of fossil fuel and hydroelectric plants, power grids, and load control. Except for some new load simulation modules, the vendors associated with the transportation industry have similar specialized experience and resources.

The remainder of the vertical markets are smaller with fewer opportunities and relatively tight budget prospects. Several of the SI leaders appear to have developed work along technical lines and then leveraged the experience into related industries. Any reduction of economic growth would most likely affect the smaller industry markets directly.

The principal emphasis of the "other" class is education, with no reported agricultural projects. It should be noted that a weakness in the vertical industry definitions allows projects in the academic environment to be split between state and local government and education.



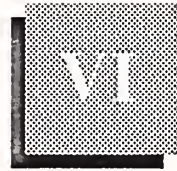




## Market Strategies and Recommendations







## Market Strategies and Recommendations

The attractions of the systems integration market can obscure the very real risks that vendors face when transacting business in this market, the risks to the company's finances and reputation when systems integration projects fail. Regardless of the reason(s) for failure and the source of the "fault," the integrator must bear the brunt of the repercussions. The considerable investment and importance of these projects to the client organizations, and the publicity such projects receive make it unlikely that failure will be overlooked by investors, potential clients, and competition.

The steps to success as a systems integrator require the creation and imposition of careful marketing, opportunity qualification, disciplined bid preparation, and established program management practices. Diligent competitor evaluation, continuous pre-sale development, and creation of a committed team in-house and with partner/alliances are essential to achieve the rewards of successfully completed systems integration projects. Vendors must also diligently assess, manage, and contain the inherent risks. These are not one-time activities, but rather constant monitoring of the system integration plan and its execution.

### A

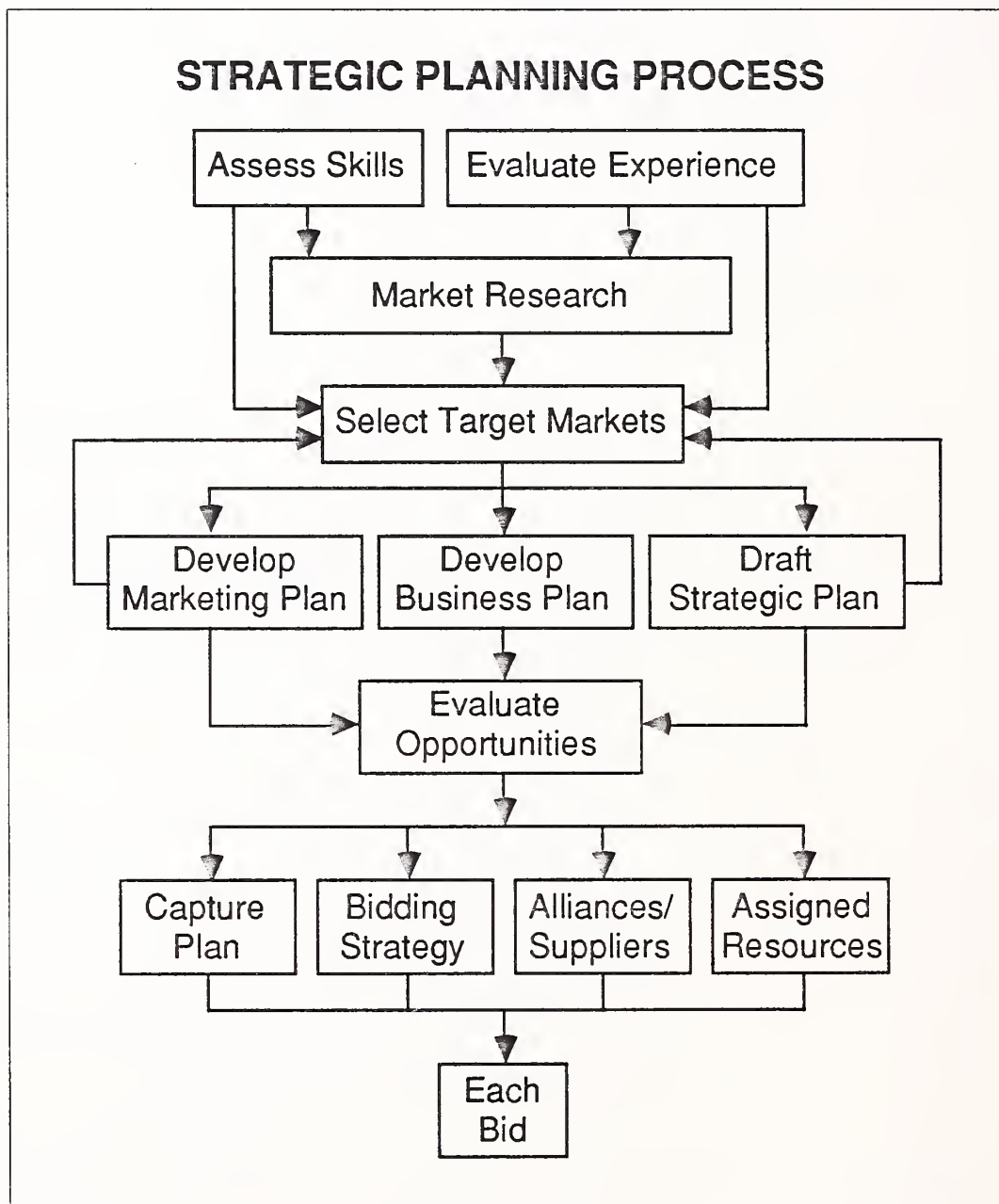
#### Market and Opportunity Identification

The leading SI vendors do not publicly divulge their strategies, target opportunities, and many of their internal bidding procedures. Nor do they explain the tactical plans and final winning steps as they pick off highly desirable commercial and federal contracts.

Elements of the processes they employ eventually become apparent through post-award announcements, market analysts, press coverage, professional lectures, and competitor comments. The process outlined in Exhibit VI-1 is an amalgamation of the same methodology used in other highly competitive businesses. The key step, however, is development of strategic plans and selection of strategic goals *after* careful assessment of

internal resources and comparison with the requirements of desirable markets, either industry-specific, cross-industry, or some suitable combination.

EXHIBIT VI-1



An important aspect of the process is that it is a continuing process, with results of later steps fed back for fine tuning, and course corrections when needed. Less time is consumed in selecting the markets if the in-house resource assessment is performed first.

A market or submarket should be selected that demonstrates the prospects for a series of bids that can leverage on the earlier efforts. And, at first, the selection should be fairly narrow, with one or two alternates that could be followed if the prime selection doesn't produce contracts.



Several mid-size competitors took stock of their diversification efforts in 1988 and elected to shut down departments and divisions that were unsuccessful in their marketing. Most admitted that resources were diffused by too many parallel demands, and too few real opportunities.

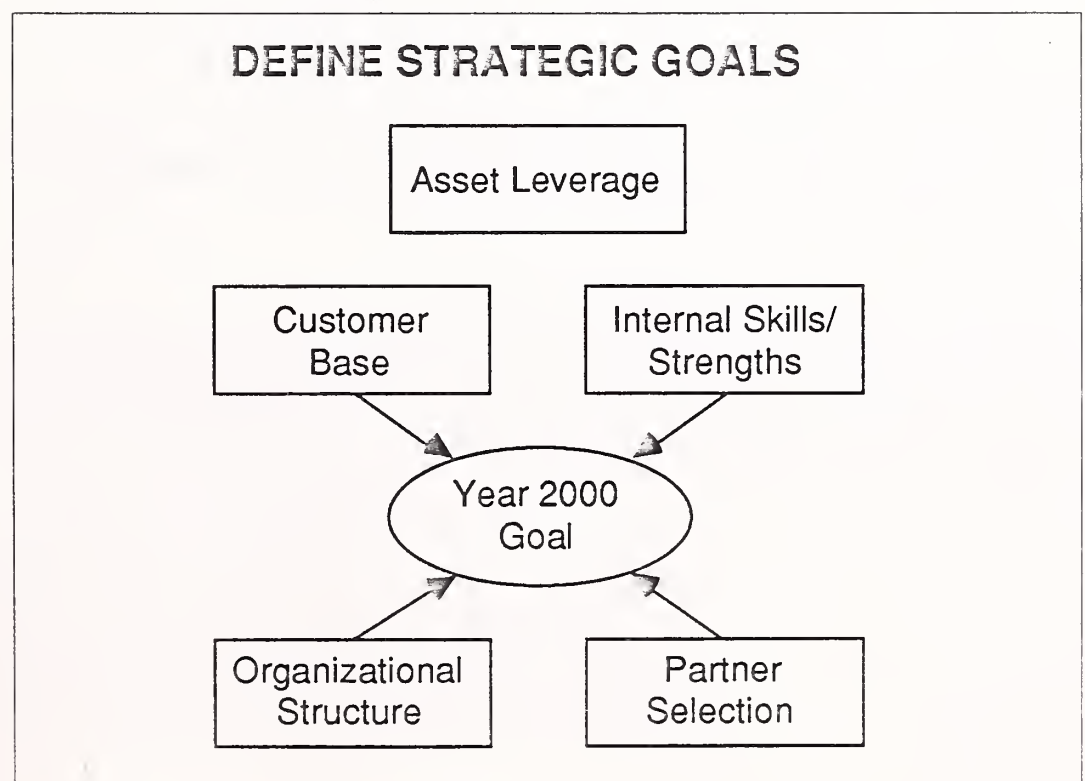
Opportunities that do not fit within the limits of the (tactical) business plan or do not focus on the longer term strategic goal(s) must be declined before any serious resource commitments take place.

The capture plan must consider the client's stated and presumed objectives, the probable strategy of the leading competitor(s), the pre-sale activities to improve image, and the selection of partners/allies. The bidding strategy must consider resource commitment, proposal development, key selling points, real cost and potential cost exposures, and the negotiable price range.

Reference should be made to Section III, Market Forecast and Section IV, Industry Markets, for some preliminary guidance on market growth potential, key opportunity areas, and some industry-unique hurdles to overcome.

Early in the process, the SI vendor/candidate needs to define the company's strategic goal(s). The goals need to be realistic, clearly and definitively stated in writing, and communicated to the whole organization. Painstaking care should be taken to avoid frequent restatement, which can lead to confusion. The key elements are identified in Exhibit VI-2.

EXHIBIT VI-2



Partner selection and alliances will be discussed later, but an accurate assessment must first be made of internal skills, strengths, and weaknesses, as mapped against the needs to be met to attain the long-range goal. The level of retention of the existing customer base will determine what and how much external resource will be needed to reach the goal.

**B****Marketing and Sales**

In the early stages of the SI market development, the degree to which vendors are able to leverage their marketing strengths to focus on the target markets will determine who obtains the early lead, as shown in Exhibit VI-3. Although IBM, EDS/AM, CSC, and Arthur Andersen all have corporate policies limiting them from disclosing details of their business, it is their practice (and that of every vendor) to leverage early contract successes to give them a high degree of visibility.

EXHIBIT VI-3

**MARKETING IS KEY**

- IBM, CSC, EDS/GM, and Arthur Andersen show:
  - Marketing/sales strength
  - CSI/FSI focus leadership
  - Early success in the market
  - Early alliance formations key to market
  - Executive management interest

Market positioning (or the ability to occupy a specific place and fulfill a specific role in the market) is not only dependent on the natural skill base that a vendor may have but also, at this stage of the market development, a question of posturing (seizing the high ground in a given market area and holding it).

Technical positioning is a different matter altogether as outlined in Exhibit VI-4. Here a vendor must compare his abilities with respect to the target market(s) in terms of industry processes (e.g., shop floor operations in manufacturing) and typical hardware and systems software environments found (e.g., DEC/VMS, IBM/VM/MVS) in addition to the applicational requirements of the individual companies.

The vendor must also carefully evaluate the strengths and weakness of the competition and their probable ranking as most likely to be awarded the contract. Unless the vendor can be sure to be considered at least in the top three competitors, it would be well advised to "walk away" before investing precious money in a "can't win" situation.

## EXHIBIT VI-4

**MARKET ANALYSIS**

- Examine target market potential
  - Ability to fund
  - State of user sophistication
  - Number of SI projects in next five years
- Vendor image in market
- Competitor market penetration

It is essential that an appraisal be made of the company's knowledge of the industry processes found in the target market, particularly those vertical market processes that will be the foundation of the vendor's ability to counsel users on CSI implementations. While it is possible to participate in systems integration projects that do no more than update the technical solutions to a process that has already been automated, the future belongs to those vendors who are able to innovate at the industry process level.

The pre-sales effort should also be carefully planned to maximize use of early marketing information and to contribute effectively to the vendor's overall understanding of the market, the opportunities, and the key prospective clients. Sales people need to begin identification of the key players in the client decision chain and to develop a sense of the average project values awarded in the market.



## C

Bid/Proposal  
Preparation

The bid/proposal preparation process begins with some indication that a prospective client intends to award a contract for implementation of a system. In the federal market it can be included in a briefing to industry or notice of "sources sought" in the CBD (Commerce Business Daily-published by the Commerce Department). Most commercial market leads begin with an informal inquiry, but some advertise intention of issuing a letter of solicitation.

In all but a few special areas, governments use well defined SI functional or system performance specifications, and frequently ask for industry comments on the proposed procurement. Only about 20% of the current commercial SI sector uses the request for proposal (RFP) involving project specifications and stated bid evaluation criteria.

At the very least, vendors should develop a detailed checklist of generic tasks associated with the SI project along the lines of Exhibit VI-5. This checklist can be used in early conversations with the client to discuss both what the project entails and whether the integrator or the IS staff is to take responsibility for each individual task.

A strategic decision needs to be made by the CSI bidder, in the absence of formal statements, to establish the congruence between what the client "wants," "needs," and is willing to pay for. To avoid potential pitfalls, CSI vendors may prefer to propose feasibility studies as a first step in a major project. This early participation in a consultancy role has the additional advantage of establishing a level of comfort between contractor and client that may pay off in managing the project and the client later.

Considering the performance of the tasks outlined in Exhibit VI-5, the investment required of vendors in developing a bid is substantial, perhaps involving 5% to 6% of the contract value. Significant amounts of time and money must be spent in understanding the functional requirements, technical specifications, time and financial constraints, business terms and conditions, other salient factors (internal politics, key decision makers, buyer perceptions), and the selection process and evaluation criteria to be used in the process.

Once these specifics are uncovered and understood, additional time and money must be expended on developing the bid. An assessment of in-house capabilities must be made vis-a-vis the requirements. What does the bidder bring to the project? This suggests the need to conduct an internal skills inventory that can be leveraged and an assessment of skills needed to be acquired.



## EXHIBIT VI-5

**BID DEVELOPMENT AND INVESTMENT**

- Requirements analysis
  - "Wants" versus "needs"
  - Functional solution
  - Feasibility
- Proposal basis
  - System architecture
  - Equipment and software
  - Delivery requirements
  - Acceptance criteria
- Staffing
  - Project management
  - In-house staff
  - Outside skill needs
- Environment
  - Installation
  - Training
- Costing
  - Labor
  - Materials
  - Markup
- Competitive analysis
- Competitive pricing

The time to develop partners and alliances is at as early a stage in the bidding process as possible, even before the formal process begins. Strong alliances can help to construct a winning bid by highlighting their experiences and discussing features beneficial to the client. The field sales and middle management personnel of allies and subcontractors can function as additional intelligence gatherers about the competition.

There are and should be a sense of uneasiness about alliances by many SI vendors, who would prefer arms-length subcontract relations with suppliers. There have been several excellent publications on this subject from the business graduate schools of MIT, Harvard, and UCLA. The essence of the UCLA study is noted briefly in Exhibit VI-6, and also discussed in Section III.

EXHIBIT VI-6

### PROBLEMS OF VENDOR ALLIANCES

- Problems
  - Impact of environmental forces
  - Short-term differences in performance
  - Perceptions versus actual benefits
  - Unwillingness to share key assets
  - Differences in business culture
- Steps to minimize failures
  - Clearly determine common objectives
  - Communicate strategy to operating people
  - Avoid complexity
  - Insulate alliances from partners

The problems that contribute to the failure of alliances can occur quickly if adequate planning and execution of the agreement do not occur promptly. Failure to identify roles and responsibilities clearly and how key assets will be shared are quoted frequently as problems, as are differences in business culture.

Avoidance steps can be taken to prevent the type of distrust that prevents the alliance from being a winning combination. Clearly written objectives in the hands of key managers and open communication appear to be the most effective tools. But alliances are rarely intended to last long, and should be planned accordingly.

Some potential projects will be so technically advanced as to invite the question, "Can it be done?" For these projects an investment in engineering a prototype may be required. If the prototyping requirement is expensive, the buyer may be willing to underwrite or share the cost.

The significant investment for the bidder comes in competitive analysis. Much more than listing the strengths and weaknesses of the competition, this assessment requires the development of an "as if" bid. In this method the bidder's staff actually develops the bid that they think the competitor might submit. The bidder's actual bid must beat this "straw man" bid in the internal review before being submitted to the buyer. When the size of the award warrants, the internal effort applied to the development of these two bids, and an accurate appraisal, can result in a very strong and, hopefully, winning bid.

## D

### Project and User Management

Project management requirements have been emphasized throughout this report and will not be elaborated further here. Skill in these associated tasks is critical to managing/containing risks, and vendors need to have a deep understanding of the theory and techniques and a strong set of supporting tools.

One aspect of project management frequently overlooked by contractors is the need to vest contract authority in the project manager. In time-critical projects, layered management can impede the schedule and add unnecessary risks. The results of assigning responsibility to a single manager who can act quickly far outweigh the results of the risks of project delays and cost overruns.

Another aspect of management frequently neglected in SI-type projects is the need to manage the user. The contractor does not want to be second-guessed on each decision. The user must be kept informed of impending decisions, and when decisions are made, the user must be informed of the decision and convinced that the decision was the alternative that best met the user's interests.

User management also entails avoiding surprises. Both formal and informal status reports must be made to various levels of the client organization on a timely basis, to assure ultimate acceptance.

**E****Risk Containment**

In federal projects, government regulations guide the extent to which the agency client shares the performance and cost risk with the SI vendor. In the commercial sector, the primary responsibility is assigned to the CSI prime contractor. This does not mean that the contractor must take sole responsibility, because it is legally possible to share the risks with partners, allies, and third-party suppliers. The subcontracts must contain the provisions and the suppliers need to be made a part of the overall project team. Keys to managing risk containment are listed in Exhibit VI-7.

**EXHIBIT VI-7****MANAGE RISK CONTAINMENT**

- Extent of risk varies with project size, complexity, client sensitivity
- Risk may be shared with subcontractors
- All levels of company need to be sensitized to risk management
- Liability insurance coverage
- Risk-level assessment during bid preparation

It is essential that all levels of the vendor's organization be sensitive to the needs and procedures of risk management. Areas of potential risk should be identified during the bid preparation phase, and the extent of the probable risk exposure should be estimated.

It also seems prudent for CSI vendors to provide for tremendous legal and financial liability risks by assessing liability insurance coverage and making the necessary changes to cover the unique risks of CSI, including third-party failures and dissatisfaction of the client on delivery.



**F****Bid Selection and  
User Purchase  
Criteria**

Beyond the technical content, the SI vendor's bid must also reflect a congruence between the buyer's perception of in-house strengths and weaknesses and the capabilities of the bidder. The bid should leave the buyer with the feeling that the bidder recognizes these capabilities and has plans for covering the weaknesses.

Individual client organizations differ with respect to the extent these vendor strengths and weaknesses impact the valuation given the bidder, largely influenced by the IS staff knowledge of the industry and the applications.

Unless the bid solicitation dictates otherwise, the bid should exclude services that the vendor might like to provide but which have a low requirement—multivendor maintenance, maintenance of a network, and total system maintenance are just three examples.

The type of contract proposed by the bidder makes a strong statement of the bidder's concern about the risks involved and his confidence in managing and containing this risk. A fixed-price contract with performance guarantees and even strong penalty clauses tells the buyer of the bidder's confidence in successfully completing the project to the buyer's satisfaction.

Fixed-price contracts with performance guarantees are currently much more acceptable to clients than other types of business terms, including fixed prices without those guarantees. The performance guarantee requirement is a risk trade off from the client's perspective. With diminished control over the developing system, users seek maximum assurance through guarantees. In many situations this "guarantee" becomes mandatory.

Another area of risk to the vendor is the terms and conditions of acceptance criteria. The separate INPUT report on buyer issues noted that formal acceptance procedures were not included in 70 percent of commercial bid solicitations. The vendors noted that demonstration and acceptance can either be proposed in the bid or become part of the final contract negotiation. Provision of the procedure in the bid can help the user feel more confident about the vendor.

The report on buyer issues also provides additional guidance to CSI vendors on bidding times, management involvement, user involvement, training, and procurement methods in more detail than can be provided in this report.

**G****Recommendations**

Suggestions for getting started or improving probabilities of success have been included in Section III and throughout this section. The key points that have been made are listed in Exhibit VI-8.

EXHIBIT VI-8

**RECOMMENDATIONS**

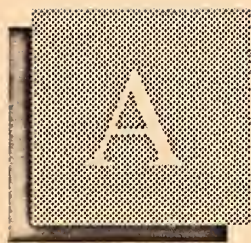
- Select targets and markets carefully
- Advertise expertise in application areas
- Demonstrate knowledge of technology
- Establish strong alliances
- Employ risk management policies
- Demonstrate risk acceptance
- Procedurize bid preparation
- Demonstrate project management skills

- Select markets and target projects that either are, or can become, a natural “fit” for the company’s skills, experience, and resources. Bring in allies or subcontractors who will fill the voids.
- Advertise company expertise in key industries and applications to build an image with potential clients and attract valuable third-party assistance
- Demonstrate expertise in both current and new technology that has direct applicability to the targeted industry markets
- Establish strong alliances that can help overpower the competition, but make them part of the company team, to offer a united front to the client

- Employ risk-management assessment and containment policies and advertise the availability of these skills in the company
- Demonstrate risk acceptance with fixed price bids with performance guarantees and penalty clauses to tell the buyer of confidence in completing the project
- Use disciplined bid preparation procedures with administrative control, document handling, and cost accounting techniques
- Demonstrate project management (and user management) skills with formal policies and vested authority to control the project and interface client management directly

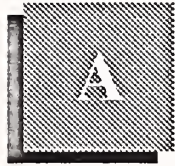






## Appendix: Definitions





## Appendix: Definitions

Appendix A contains the definitions used by INPUT to describe the Information Services Industry.

*Information Services* - Computer-related services involving one or more of the following:

- Processing of computer-based applications using vendor computers (called "processing services")
- Network-oriented services or functions such as value-added networks, electronic mail, electronic document interchange, on-line data bases, news data bases, videotex
- Products and services that assist users in performing functions on their own computers or vendor computers (called "software products" or "professional services")
- Services that utilize a combination of hardware and software, integrated into a total system (called "turnkey systems" and/or "systems integration")

All user expenditures reported are "available" (i.e., noncaptive, as defined below).

### A

#### User Expenditures

*Noncaptive Information Services User Expenditures* - Expenditures paid for information services provided by a vendor that is not part of the same parent corporation as the user

*Captive Information Services User Expenditures*—Expenditures received from users who are part of the same parent corporation as the vendor.

## B

### Delivery Modes

#### 1. Processing Services

This category includes transaction processing, utility processing, other processing services, and systems operations.

- *Transaction Processing Services* - Updates client-owned data files by entry of specific business activity, such as sales order, inventory receipt, cash disbursement, etc. Transactions may be entered in one of three modes.
  - *Interactive* - Characterized by the interaction of the user with the system, primarily for problem-solving timesharing, but also for data entry and transaction processing; the user is on-line to the program/files. Computer response is usually measured in seconds or fractions of a second.
  - *Remote Batch* - Where the user hands over control of a job to the vendor's computer, which schedules job execution according to priorities and resource requirements. Computer response is measured in minutes or hours.
  - *User Site Hardware Services (USHS)* - Those offerings provided by processing services vendors that place programmable hardware at the user's site rather than at the vendor's data center. Some vendors in the federal government market provide this service under the label of distributed data services. USHS offers:
    - ° Access to a communications network
    - ° Access through the network to the RCS vendor's larger computers
    - ° Local management and storage of a data base subset that will service local terminal users via the connection of a data base processor to the network.
    - ° Significant software as part of the service
  - *Carry-in Batch* - Where users deliver work to a processing services vendor
- *Utility Processing* - Vendor provides access to basic software tools, enabling the users to develop their own problem solutions such as language compilers assemblers, DBMS, sorts scientific library routines, and other systems software.



- *"Other" Processing Services* - Include computer output microfilm, other data output services, data entry services, disaster recovery and backup services.
- *Systems Operations (Processing)* - Also referred to as "resource management," facilities management, or "COCO" (contractor-owned, contractor-operated). Systems control is the management of all or part of a user's data processing functions under a long-term contract of not less than one year. This would include remote computing and batch services. To qualify, the contractor must directly plan, control, operate, and own the facility provided to the user—either onsite, through communications lines, or in a mixed mode.

Processing services are further differentiated as follows:

- *Cross-industry* services involve the processing of applications that are targeted to specific user departments (e.g., finance, personnel, sales) but that cut across industry lines. Most general-ledger, accounts receivable, payroll, and personnel applications fall into this category. General-purpose tools such as financial planning systems, linear regression packages, and other statistical routines are also included. However, when the application, tool, or data base is designed for specific industry use, then the service is industry-specific (see below).
- *Industry-specific* services provide processing for particular functions or problems unique to an industry or industry group. Specialty applications can be either business or scientific in orientation. Examples of industry-specialty applications are seismic data processing, numerically controlled machine tool software development, and demand deposit accounting.

## 2. Network Services

Network services include a wide variety of network-based functions and operations. Their common thread is that none of these functions could be performed without network involvement. Network services is divided into two major segments: network applications and electronic information systems.

### a. Network Applications

The network applications segment is composed of three subsets:

- *Value-Added Networks (VANs)* - VANs typically involve common carrier network transmission facilities that are augmented with computerized switched. These networks have become associated with packet-switching technology because the public VANs that have received the most attention (e.g., Telenet and TYMNET) employ packet-switching

techniques. However, other added data service features, such as store-and-forward message switching, terminal interfacing, error detection and correction, and host computer interfacing, are of equal importance.

- *Electronic Data Interchange (EDI)* - EDI is the application-to-application electronic communications between organizations, based on established business document standards.
- *Electronic Mail (E-Mail)* - Transmission of messages across an electronic mail network managed by a services vendor.

#### **b. Electronic Information Services**

Electronic information services are data bases that provide specific terminal-based inquiry such as stock prices, legal precedents, economic indicators, medical diagnosis, airline schedules, current news stories, automobile valuations, etc. Users typically inquire into and extract information from these data bases but do not update them.

### **3. Software Products**

This category includes user purchases of applications and systems software packages for in-house computer systems. Included are lease and purchase expenditures, as well as expenditures for work performed by the vendor to implement or maintain the package at the user's sites.

Expenditures for work performed by organizations other than the package vendor are counted in the category of professional services. Fees for work related to education, consulting, and/or custom modification of software products are counted as professional services, provided such fees are charged separately from the price of the software product itself.

There are several subcategories of software products, as indicated below.

#### **a. Applications Software Products**

Applications software products perform functions directly related to solving user's business or organizational need. The products can be:

- *Cross-Industry Products* - Used in multiple-industry applications as well as the federal government sector. Examples are payroll, inventory control, and financial planning.
- *Industry-Specific Products* - Used only in a specific industry sector, such as banking and finance, transportation, or discrete manufacturing. Examples are demand deposit accounting, airline scheduling, material resource planning, and insurance claim management.

## b. Systems Software Products

Systems software products enable the computer/communications system to perform basic machine-oriented or user interface functions. These products include:

- *System Control Products* - Function during applications program execution to manage the computer system's resources. Examples include operating systems, communication monitors, emulators, spoolers, network control, library control, windowing, access control.
- *Data Center Management Products* - Used by operations personnel to manage the computer system's resources and personnel more effectively. Examples include performance measurement, job accounting, computer operations scheduling, utilities, capacity management.
- *Applications Development Products* - Used to prepare applications for execution by assisting in designing, programming, testing, and related functions. Examples include traditional programming languages, 4GLs, sorts, productivity aids, assemblers, compilers, data dictionaries, data base management systems, report writers, project control and CASE systems.

## 4. Turnkey Systems

A turnkey system is an integration of systems and applications software with CPU hardware and peripherals, packaged as a single application (or set of applications) solution. The value added by the vendor is primarily in the software and support. Most CAD/CAM systems and many small-business systems are turnkey systems. This does not include specialized hardware systems such as word processors, cash registers, or process control systems, nor does it include Embedded Computer Resources for military applications. Turnkey systems may be either custom or packaged systems.

- Hardware vendors that combine software with their own general-purpose hardware are not classified by INPUT as turnkey vendors. Their software revenues are included in the appropriate software category.
- Turnkey systems revenue is divided into two categories.
  - *Industry-Specific Systems* - Systems that serve a specific function for a given industry sector, such as automobile dealer parts inventory, medical recordkeeping, or discrete manufacturing control systems
  - *Cross-Industry Systems* - Systems that provide a specific function that is applicable to a wide range of industry sectors, such as financial planning systems, payroll systems, or personnel management systems



- Revenue includes hardware, software, and support functions.

## 5. Systems Integration (SI)

Systems Integration is a business offering that provides a complete solution to a complex information system, networking, or automation requirement through the custom selection and implementation of a variety of products and services.

A system integrator is a business organization responsible for overall management of a systems integration contract and is the single point of contact and responsibility to the buyer for delivery of the specified system function and performance on schedule and at the contracted price.

The systems integrator will perform, or manage others who perform, most or all of the following functions:

- Program management, including subcontractor management
- Needs analysis
- Specification development
- Conceptual and detailed system design/architecture
- System component selection, modification integration, and customization
- Custom software design and development
- Custom hardware design and development
- System implementation, cutover, test, and evaluation
- Life cycle support, including:
  - System documentation and user training
  - System operation and/or management
  - System maintenance
- Financing



## 6. Professional Services

This category includes consulting, education and training, software development, and systems operations as defined below.

- *Software Development* - Development of a software system on a custom basis. It includes one or more of the following: user requirements definition, system design, contract programming, documentation.
- *Education and Training* - Products and/or services related to information systems and services for the user, including computer-aided instruction (CAI), computer-based education (CBE), and vendor instruction of user personnel in operations, programming, and maintenance.
- *Consulting Services* - Information systems and/or services management consulting, project assistance (technical and/or management), feasibility analyses, and cost-effectiveness trade-off studies.
- *Systems Operations (Professional Services)* - This is a counterpart to systems operations (processing services) except the computing equipment is owned or leased by the client, not by the vendor. The vendor provides the staff to operate, maintain, and manage the client's facility.

## C

### Equipment/Computer Systems

#### 1. Equipment

Equipment includes all computer and telecommunications equipment that can be separately acquired with or without installation by the vendor and not acquired as part of an integrated system.

- *Peripherals* - Includes all input, output, communications, and storage devices (other than main memory) that can be connected locally to the main processor and generally cannot be included in other categories such as terminals
- *Input Devices* - Includes keyboards, numeric pads, card readers, light pens and track balls, tape readers, position and motion sensors, and analog-to-digital converters
- *Output Devices* - Includes printers, CRTs, projection television screens, micrographics processors, digital graphics, and plotters
- *Communication Devices* - Includes modems, encryption equipment, special interfaces, and error control
- *Storage Devices* - Includes magnetic tape (reel, cartridge, and cassette), floppy and hard disks, solid state (integrated circuits), and bubble and optical memories

- *Terminals* - Three types of terminals are described below:
  - *User-Programmable* - Also called intelligent terminals, including:
    - Single-station or standalone
    - Multistation shared processor
    - Teleprinter
    - Remote batch
  - *User Nonprogrammable*
    - Single-station
    - Multistation shared processor
    - Teleprinter
  - *Limited Function* - Originally developed for specific needs, such as point-of-sale (POS), inventory data collection, controlled access, and other applications.

## 2. Computer Systems

Computer systems include all processors from microcomputers to super-computers. Computer systems may require type- or model-unique operating software to be functional, but this category excludes applications software and peripheral devices.

- *Microcomputer (Price below \$15,000)* - Combines all of the CPU, memory, and peripheral functions of an 8- or 16-bit computer on a chip in the form of:
  - Integrated circuit package
  - Plug-in board with more memory and peripheral circuits
  - Console including keyboard and interfacing connectors
  - Personal computer with at least one external storage device directly addressable by the CPU
- *Workstation (Price between \$10,000 and \$100,000)* - An integrated multifunctional workstation capable of routine higher-speed communications with mini and mainframe computers and of performing complex local processing. While similar to microcomputers, the workstation typically will have 16- or 32-bit architectures, plus greater graphics and integrated communications capabilities.
- *Minicomputer (Price between \$15,000 and \$350,000)* - Usually a 16- or 32-bit computer. May represent a portion of a larger system or a complete stand-alone system by itself.
  - Personal business computer

- Small laboratory computer
- Nodal computer in a distributed data network, remote data collection network, or connected network, or connected to remote microcomputers
- *Mainframe (Price above \$350,000)* - Typically a 32- or 64-bit computer with extensive applications software and a number of peripherals in standalone or multiple-CPU configurations for business (administrative, personnel, and logistics) applications; also called a general-purpose computer.
- *Supercomputer* - High-powered processors with numerical processing throughout that is significantly greater than the fastest general-purpose computers, with capacities in the vicinity of 10-50 million floating point operations per second (MFLOPS). Supercomputers fit in one of two categories:
  - *Real Time* - Generally used for signal processing in military applications.
  - *Non-Real Time* - For scientific use in one of three configurations:
    - Parallel processors
    - Pipeline processor
    - Vector processor
- *Embedded Computer* - Dedicated computer system designed and implemented as an integral part of a weapon, weapon system, or platform; critical to a military or intelligence mission such as command and control, cryptological activities, or intelligence activities. Characterized by military specifications (MIL SPEC) appearance and operation, limited but reprogrammable applications software, and permanent or semipermanent interfaces. May vary in capacity from microcomputers to parallel processor computer systems.

## D

### Telecommunications

#### 1. Networks

Networks are the electronic interconnections between sites or locations that may incorporate links between central computer sites and remote locations and switching and/or regional data processing nodes. Network services typically are provided on a leased basis by a vendor to move data, voice, video, or textual information between locations. Networks can be categorized in several different ways.

- *Common Carrier Network* - A public access network, such as provided by AT&T, consisting of conventional voice-grade circuits and regular switching facilities accessed through dial-up calling with leased or user-owned modems for transfer rates between 150 and 1200 baud



- *Value-Added Network (VAN)* - (See listing under Section B.2, Delivery Modes.)
- *Local Area Network (LAN)* - Limited-access network between computing resources in a relatively small (but not necessarily contiguous) area, such as a building, complex of buildings, or buildings distributed within a metropolitan area. Uses one of two signaling methods.
  - *Baseband* - Signaling using digital waveforms on a single frequency band, usually at voice frequencies and bandwidth, and limited to a single sender at any given moment. When used for local-area networks, typically implemented with TDM to permit multiple access.
  - *Broadband* - Transmission facilities that use frequencies greater than normal voice-grade, supported in local-area networks with RF modems and AC signaling. Also known as wideband. Employs multiplexing techniques that increase carrier frequency between terminals to provide:
    - Multiple (simultaneous) channels via FDM (Frequency Division Multiplexing)
    - Multiple (time-sequenced) channels via TDM (Time Division Multiplexing)
    - High-speed data transfer rate via parallel mode at rates of up to 96,000 baud (or higher, depending on media)

## 2. Transmission Facilities

Transmission facilities include wire, carrier, coaxial cable, microwave, optical fiber, satellites, cellular radio, and marine cable operating in one of two modes, depending on the vendor and the distribution of the network.

- *Mode* - may be either:
  - *Analog* - Transmission or signal with continuous-waveform representation, typified by AT&T's predominantly voice-grade DDD network and most telephone operating company distribution systems
  - *Digital* - Transmission or signal using discontinuous, discrete quantities to represent data, which may be voice, data, record, video, or text, in binary form
- *Media* - May be any of the following:



- *Wire* - Varies from earlier single-line teletype networks, to two-wire standard telephone (twisted pair), to four-wire full- duplex balanced lines
- *Carrier* - A wave, pulse train, or other signal suitable for modulation by an information-bearing signal to be transmitted over a communications system, used in multiplexing applications to increase network capacity
- *Coaxial Cable* - A cable used in HF (high-frequency) and VHF (very high frequency), single-frequency, or carrier-based systems; requires frequent reamplification (repeaters) to carry the signal any distance
- *Microwave* - UHF (ultra-high-frequency) multichannel, point-to-point, repeated radio transmission; also capable of wide frequency channels
- *Optical Fiber* - Local signal distribution systems employed in limited areas, using light-transmitting glass fibers and TDM for multichannel applications
- *Communications Satellites* - Synchronous earth-orbiting systems that provide point-to-point, two-way service over significant distances without intermediate amplification (repeaters), but requiring suitable groundstation facilities for up- and down-link operation
- *Cellular Radio* - Network of fixed, low-powered two-way radios that are linked by a computer system to track mobile phone/data set units. Each radio serves a small area called a cell. The computer switches service connections to the mobile unit from cell to cell.

## E

### Definitions

- Bill of Material (BOM). A listing of all subassemblies, parts, and materials that go into an assembled part (showing the quantities of each).
- CAD/CAE. The integrated applications of CAD and CAE.
- Capacity Requirements Planning. The translation of open shop orders and planned shop orders into hours of work by time period and work center.
- Computer-Aided Design (CAD). Applications of computer and graphic technology to engineering, design, and drafting.
- Computer-Aided Engineering (CAE). The use of the full range of software and systems to model, simulate, and analyze a product before construction of production models.

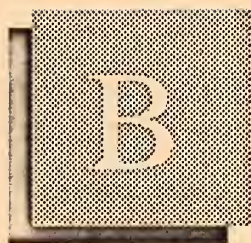
- Computer-Aided Maintenance Management (Camm). Systems for analyzing and scheduling maintenance in manufacturing plants. The predictive maintenance functions would be the next logical development.
- Computer-Integrated Manufacturing (CIM). Integration of separately automated factory functions. These functions include MRP II, CAD/CAE, DSS, process control, ATE, and robotics. CIM is a philosophy of operations requiring management commitment.
- Electronic Data/Document Interchange (EDI). The use of a communications network to transmit and receive electronic business transactions between multiple locations on an intra- or inter-company basis.
- Finite Element Analysis. As used in this report, includes all tasks involved in structural analysis using finite element methods—mesh generation, preprocessing, finite element analysis processing, and post-processing.
- Group Technology. The application of classification and coding technology to search a data base for information on similar parts and to apply this to CAD and CAM tasks.
- Material Production Schedule. An anticipated build schedule that drives the MRP systems.
- Manufacturing Resource Planning (MRPII). An extension of MRP where MRP is integrated with financial planning, a simulation capability, and other functions on a closed-loop basis for the planning of all of the resources of a manufacturing company.
- Nesting. Software to automatically or interactively arrange patterns for parts within stock material boundaries.
- Numerical Control (NC). Fixed sequence control of machine tool programs. (Also see DNC—Direct Numerical Control.)
- Shipments. The dollar equivalent of products shipped by a manufacturing establishment. Will usually be approximately equal to revenue.
- Shop Floor Control. Control of the progress of each customer order or stock order through the operations of its production cycle and the collection of data about actual completion status.
- Value Added. The portion of product shipment values originating in that industry; includes factors such as labor costs, depreciation, various business expenses, and energy costs. It is basically the difference between shipments and raw or input materials costs.

**F****Other Definitions**

- **Data Base Management System (DBMS).** A software system that allows a user to structure a data base by defining the data, its organization, and the association between data elements. It also includes a data manipulation language (for accessing, sorting, merging, etc.) and controls for concurrent use (security, request, queuing, etc.). Functions as a common interface to multiple applications.
- **Distributed Data Base.** A data base that is physically located at multiple sites, with each site having a part of the total data base. The sites are usually linked to a central site and have access to each other.
- **Distributed Processing.** Multiple computers simultaneously processing elements of a CAD task.
- **Management Information System (MIS).** A DP system specifically designed to provide business managers with company, financial, project, or program data.
- **Networking.** The interconnection and control of remotely located systems and devices over communications lines.



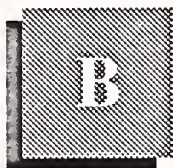




## Appendix: Industry Sector Definitions







## Appendix: Industry Sector Definitions

The standard industrial classification (SIC) codes are used to define the economic activity contained in generic sectors such as process manufacturing, insurance, or transportation.

The specific industries (and their SIC codes) included under these generic industry sectors are detailed in the exhibit.

## EXHIBIT B-1

**INDUSTRY SECTOR DEFINITIONS**

INDUSTRY SECTOR	INDUSTRY SIC	INDUSTRY NAME
Discrete Manufacturing	23	Apparel
	25	Furniture
	27	Printing
	31	Leather
	34	Metal
	35	Machinery
	36	Electronics
	37	Transportation
	38	Scientific and Control Instruments
	39	Miscellaneous
Process Manufacturing	10	Metal Mining
	11	Anthracite Mining
	12	Coal Mining
	13	Oil and Gas Extraction
	14	Mining/Quarrying of Non-Metallic Minerals, except Fuels
	20	Food Products
	21	Tobacco
	22	Textile Products
	24	Lumber and Wood Products
	26	Paper Products
	28	Chemicals
	29	Petroleum
	30	Rubber and Plastics
	32	Stone, Glass, Clay
	33	Primary Metals
Transportation	40	Railroads
	41	Local Transit
	42	Motor Freight
	43	U.S. Postal Service
	44	Water Transportation
	45	Air
	46	Pipelines
	47	Transportation Services



## EXHIBIT B-1 (Cont.)

**INDUSTRY SECTOR DEFINITIONS**

INDUSTRY SECTOR	INDUSTRY SIC	INDUSTRY NAME
Utilities	49	Electric, Gas, and Sanitary
Telecommunications	48	Communications
Wholesale Distribution	50	Durable Goods
	51	Nondurable Goods
Retail Distribution	52	Building Materials, Hardware
	53	General Merchandise
	54	Food
	55	Automotive and Gas Stations
	56	Apparel
	57	Furniture
	58	Eating and Drinking
	59	Miscellaneous Retail
Banking and Finance	60	Banks
	61	Credit Agencies
	62	Security and Commodity Brokers
	67	Holding and Investment Offices
Insurance	63	Insurance (Life, Health, Etc.)
	64	Insurance Agents
Medical	80	Health Services

## EXHIBIT B-1 (Cont.)

**INDUSTRY SECTOR DEFINITIONS**

INDUSTRY SECTOR	INDUSTRY SIC	INDUSTRY NAME
Services	72	Personal Services
	73	Business Services (Excluding Information Services Companies Themselves)
	89	Miscellaneous Services
	66	Combinations of Real Estate, Insurance, Loans, Law Offices
	81	Legal Services
	76	Miscellaneous Repair
Federal Government	N/A	As Appropriate
State and Local Government	N/A	As Appropriate
Other Industries	01-09	Agriculture, Forestry, and Fishing
	15-17	Construction
	70	Hotels, Rooming Houses, Camps, and Other Lodging Places
	75	Automotive Repair, Services, and Garages
	78	Motion Pictures
	79	Amusement and Recreation Services, except Motion Pictures
	82	Educational Services
	83	Social Services
	84	Museums, Art Galleries, Botanical and Zoological Gardens
	86	Membership Organizations

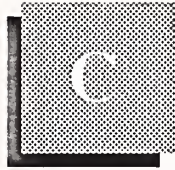


# Appendix: Systems Integration Forecast Data Base, 1988-1993









## Appendix: Systems Integration Forecast Data Base, 1988-1993

Exhibits C-1 through C-15 provide the details on which the systems integration forecasts were based, with the assumptions, base data, establishment counts, and project expenditure breakdowns.

The exhibits employ the same format used in the INPUT report *Commercial Systems Integration Markets, 1986-1991*.

## EXHIBIT C-1

## SYSTEMS INTEGRATION FORECAST DATA BASE BANKING/FINANCE

Industry Data Element	Market Size 1988	Market Size 1993	CAGR 1988- 1993 (Percent)
Number of Large Establishments	2,840	3,290	3
Establishments with Major Projects (Percent)	15	25	11
Total Major Project Expenditures (\$ Millions)	2,300	6,180	22
Expenditures Contracted (Percent)	19	39	16
Total SI Contract Value (\$ Millions)	430	2,460	42
Total SI Expenditures (\$ Millions)	230	1,485	45
<u>SI Component Expenditures (\$ Millions)</u>			
• Information Systems (Hardware)	64	386	43
• Communications (Hardware)	20	172	54
• Applications Software Packages	8	88	62
• Systems Software Packages	6	49	52
• Consulting Services	15	75	38
• Project Management Fees	11	61	41
• Design/Integration	32	191	43
• Software Development	55	348	45
• Education/Training & Documentation	3	21	48
• Operation and Maintenance	3	21	48
• Other Expenditures	13	73	41
Total SI Expenditures (\$ Millions)	230	1,485	45

## EXHIBIT C-2

# **SYSTEMS INTEGRATION FORECAST DATA BASE DISCRETE MANUFACTURING**

Industry Data Element	Market Size 1988	Market Size 1993	CAGR 1988- 1993 (Percent)
Number of Large Establishments	1,385	1,530	2
Establishments with Major Projects (Percent)	35	62	12
Total Major Project Expenditures (\$ Millions)	4,545	7,100	9
Expenditures Contracted (Percent)	33	45	6
Total SI Contract Value (\$ Millions)	1,500	3,200	16
Total SI Expenditures (\$ Millions)	580	2,310	32
<u>SI Component Expenditures (\$ Millions)</u>			
• Information Systems (Hardware)	173	808	36
• Communications (Hardware)	32	158	38
• Applications Software Packages	23	139	41
• Systems Software Packages	13	71	40
• Consulting Services	27	82	25
• Project Management Fees	23	72	26
• Design/Integration	72	235	27
• Software Development	175	622	29
• Education/Training & Documentation	9	27	25
• Operation and Maintenance	8	25	26
• Other Expenditures	25	71	23
Total SI Expenditures (\$ Millions)	580	2,310	32

## EXHIBIT C-3

## SYSTEMS INTEGRATION FORECAST DATA BASE INSURANCE

Industry Data Element	Market Size 1988	Market Size 1993	CAGR 1988- 1993 (Percent)
Number of Large Establishments	1,185	1,310	2
Establishments with Major Projects (Percent)	33	53	10
Total Major Project Expenditures (\$ Millions)	1,500	3,430	18
Expenditures Contracted (Percent)	18	25	7
Total SI Contract Value (\$ Millions)	270	850	26
Total SI Expenditures (\$ Millions)	125	450	29
<u>SI Component Expenditures (\$ Millions)</u>			
• Information Systems (Hardware)	34	140	33
• Communications (Hardware)	7	46	46
• Applications Software Packages	4	27	47
• Systems Software Packages	4	11	22
• Consulting Services	12	33	22
• Project Management Fees	9	27	25
• Design/Integration	18	58	26
• Software Development	29	80	23
• Education/Training & Documentation	2	10	38
• Operation and Maintenance	1	8	52
• Other Expenditures	5	10	15
Total SI Expenditures (\$ Millions)	125	450	29



## EXHIBIT C-4

## SYSTEMS INTEGRATION FORECAST DATA BASE MEDICAL

Industry Data Element	Market Size 1988	Market Size 1993	CAGR 1988- 1993 (Percent)
Number of Large Establishments	323	357	2
Establishments with Major Projects (Percent)	19	42	17
Total Major Project Expenditures (\$ Millions)	485	925	14
Expenditures Contracted (Percent)	33	53	10
Total SI Contract Value (\$ Millions)	160	490	25
Total SI Expenditures (\$ Millions)	160	500	26
<u>SI Component Expenditures (\$ Millions)</u>			
• Information Systems (Hardware)	58	152	21
• Communications (Hardware)	9	33	27
• Applications Software Packages	7	27	31
• Systems Software Packages	6	20	27
• Consulting Services	6	18	25
• Project Management Fees	6	18	25
• Design/Integration	13	48	30
• Software Development	43	137	26
• Education/Training & Documentation	1	7	48
• Operation and Maintenance	1	7	48
• Other Expenditures	10	33	27
Total SI Expenditures (\$ Millions)	160	500	26

## EXHIBIT C-5

# **SYSTEMS INTEGRATION FORECAST DATA BASE PROCESS MANUFACTURING**

Industry Data Element	Market Size 1988	Market Size 1993	CAGR 1988- 1993 (Percent)
Number of Large Establishments	520	540	1
Establishments with Major Projects (Percent)	27	33	4
Total Major Project Expenditures (\$ Millions)	665	1,120	11
Expenditures Contracted (Percent)	24	45	13
Total SI Contract Value (\$ Millions)	160	500	26
Total SI Expenditures (\$ Millions)	100	310	25
<u>SI Component Expenditures (\$ Millions)</u>			
• Information Systems (Hardware)	35	106	23
• Communications (Hardware)	10	33	25
• Applications Software Packages	3	9	25
• Systems Software Packages	4	11	22
• Consulting Services	3	10	27
• Project Management Fees	3	10	27
• Design/Integration	8	24	25
• Software Development	25	78	26
• Education/Training & Documentation	1	4	32
• Operation and Maintenance	1	4	32
• Other Expenditures	7	21	21
Total SI Expenditures (\$ Millions)	100	310	25

## EXHIBIT C-6

# **SYSTEMS INTEGRATION FORECAST DATA BASE RETAIL DISTRIBUTION**

Industry Data Element	Market Size 1988	Market Size 1993	CAGR 1988- 1993 (Percent)
Number of Large Establishments	1,630	1,800	2
Establishments with Major Projects (Percent)	25	50	15
Total Major Project Expenditures (\$ Millions)	1,135	3,330	54
Expenditures Contracted (Percent)	25	54	16
Total SI Contract Value (\$ Millions)	280	1,800	46
Total SI Expenditures (\$ Millions)	135	750	41
<u>SI Component Expenditures (\$ Millions)</u>			
• Information Systems (Hardware)	38	203	40
• Communications (Hardware)	11	66	43
• Applications Software Packages	3	17	41
• Systems Software Packages	6	36	43
• Consulting Services	7	36	39
• Project Management Fees	6	30	38
• Design/Integration	18	98	40
• Software Development	37	222	43
• Education/Training & Documentation	2	9	35
• Operation and Maintenance	1	9	55
• Other Expenditures	6	24	32
Total SI Expenditures (\$ Millions)	135	750	41

## EXHIBIT C-7

### SYSTEMS INTEGRATION FORECAST DATA BASE SERVICES

Industry Data Element	Market Size 1988	Market Size 1993	CAGR 1988- 1993 (Percent)
Number of Large Establishments	104	126	4
Establishments with Major Projects (Percent)	23	29	5
Total Major Project Expenditures (\$ Millions)	105	245	18
Expenditures Contracted (Percent)	48	70	8
Total SI Contract Value (\$ Millions)	50	170	26
Total SI Expenditures (\$ Millions)	30	130	34
<u>SI Component Expenditures (\$ Millions)</u>			
• Information Systems (Hardware)	8	35	34
• Communications (Hardware)	3	14	36
• Applications Software Packages	1	4	32
• Systems Software Packages	1	3	25
• Consulting Services	1	4	32
• Project Management Fees	1	4	32
• Design/Integration	4	15	30
• Software Development	8	38	37
• Education/Training & Documentation	1	3	25
• Operation and Maintenance	*	2	32
• Other Expenditures	2	8	32
Total SI Expenditures (\$ Millions)	30	130	34



## EXHIBIT C-8

# **SYSTEMS INTEGRATION FORECAST DATA BASE STATE AND LOCAL GOVERNMENT**

Industry Data Element	Market Size 1988	Market Size 1993	CAGR 1988- 1993 (Percent)
Number of Large Establishments	185	225	4
Establishments with Major Projects (Percent)	19	32	11
Total Major Project Expenditures (\$ Millions)	1,080	3,075	23
Expenditures Contracted (Percent)	49	65	6
Total SI Contract Value (\$ Millions)	530	2,000	30
Total SI Expenditures (\$ Millions)	380	1,060	23
<u>SI Component Expenditures (\$ Millions)</u>			
• Information Systems (Hardware)	113	322	23
• Communications (Hardware)	32	106	27
• Applications Software Packages	17	57	27
• Systems Software Packages	9	30	27
• Consulting Services	18	54	25
• Project Management Fees	17	45	21
• Design/Integration	33	114	28
• Software Development	104	263	20
• Education/Training & Documentation	6	15	20
• Operation and Maintenance	5	12	19
• Other Expenditures	26	42	10
Total SI Expenditures (\$ Millions)	380	1,060	23

## EXHIBIT C-9

# **SYSTEMS INTEGRATION FORECAST DATA BASE TELECOMMUNICATIONS**

Industry Data Element	Market Size 1988	Market Size 1993	CAGR 1988- 1993 (Percent)
Number of Large Establishments	156	172	2
Establishments with Major Projects (Percent)	33	58	12
Total Major Project Expenditures (\$ Millions)	530	745	7
Expenditures Contracted (Percent)	38	67	12
Total SI Contract Value (\$ Millions)	200	500	20
Total SI Expenditures (\$ Millions)	125	300	19
<u>SI Component Expenditures (\$ Millions)</u>			
• Information Systems (Hardware)	28	78	23
• Communications (Hardware)	8	19	19
• Applications Software Packages	4	10	20
• Systems Software Packages	2	4	22
• Consulting Services	5	11	17
• Project Management Fees	9	17	14
• Design/Integration	16	30	13
• Software Development	46	110	19
• Education/Training & Documentation	2	5	20
• Operation and Maintenance	1	3	25
• Other Expenditures	4	13	27
Total SI Expenditures (\$ Millions)	125	300	19

## EXHIBIT C-10

## SYSTEMS INTEGRATION FORECAST DATA BASE TRANSPORTATION

Industry Data Element	Market Size 1988	Market Size 1993	CAGR 1988- 1993 (Percent)
Number of Large Establishments	255	280	2
Establishments with Major Projects (Percent)	18	25	7
Total Major Project Expenditures (\$ Millions)	490	870	12
Expenditures Contracted (Percent)	33	38	3
Total SI Contract Value (\$ Millions)	160	330	20
Total SI Expenditures (\$ Millions)	110	335	25
<u>SI Component Expenditures (\$ Millions)</u>			
• Information Systems (Hardware)	28	91	27
• Communications (Hardware)	13	53	32
• Applications Software Packages	3	10	27
• Systems Software Packages	1	5	38
• Consulting Services	8	16	15
• Project Management Fees	5	11	17
• Design/Integration	13	28	17
• Software Development	32	99	25
• Education/Training & Documentation	2	5	20
• Operation and Maintenance	1	3	25
• Other Expenditures	4	14	28
Total SI Expenditures (\$ Millions)	110	335	25

## EXHIBIT C-11

## SYSTEMS INTEGRATION FORECAST DATA BASE UTILITIES

Industry Data Element	Market Size 1988	Market Size 1993	CAGR 1988- 1993 (Percent)
Number of Large Establishments	562	685	4
Establishments with Major Projects (Percent)	24	37	9
Total Major Project Expenditures (\$ Millions)	600	1,330	17
Expenditures Contracted (Percent)	43	75	12
Total SI Contract Value (\$ Millions)	260	1,000	31
Total SI Expenditures (\$ Millions)	170	690	32
<u>SI Component Expenditures (\$ Millions)</u>			
• Information Systems (Hardware)	61	286	36
• Communications (Hardware)	8	40	38
• Applications Software Packages	3	18	35
• Systems Software Packages	2	9	35
• Consulting Services	9	22	20
• Project Management Fees	7	19	22
• Design/Integration	14	47	27
• Software Development	56	207	30
• Education/Training & Documentation	2	7	18
• Operation and Maintenance	1	4	32
• Other Expenditures	7	31	31
Total SI Expenditures (\$ Millions)	170	690	32



## EXHIBIT C-12

### SYSTEMS INTEGRATION FORECAST DATA BASE WHOLESALE DISTRIBUTION

Industry Data Element	Market Size 1988	Market Size 1993	CAGR 1988- 1993 (Percent)
Number of Large Establishments	815	900	2
Establishments with Major Projects (Percent)	15	30	15
Total Major Project Expenditures (\$ Millions)	540	1,320	24
Expenditures Contracted (Percent)	38	42	4
Total SI Contract Value (\$ Millions)	205	560	23
Total SI Expenditures (\$ Millions)	110	310	23
<u>SI Component Expenditures (\$ Millions)</u>			
• Information Systems (Hardware)	33	85	22
• Communications (Hardware)	8	25	26
• Applications Software Packages	2	5	20
• Systems Software Packages	4	10	20
• Consulting Services	6	16	22
• Project Management Fees	5	13	21
• Design/Integration	15	40	22
• Software Development	30	94	26
• Education/Training & Documentation	1	4	32
• Operation and Maintenance	1	4	32
• Other Expenditures	5	14	23
Total SI Expenditures (\$ Millions)	110	310	23

## EXHIBIT C-13

# **SYSTEMS INTEGRATION FORECAST DATA BASE OTHER INDUSTRIES**

Industry Data Element	Market Size 1988	Market Size 1993	CAGR 1988- 1993 (Percent)
Number of Large Establishments	985	1,088	2
Establishments with Major Projects (Percent)	16	40	20
Total Major Project Expenditures (\$ Millions)	700	1,240	12
Expenditures Contracted (Percent)	30	58	14
Total SI Contract Value (\$ Millions)	210	720	28
Total SI Expenditures (\$ Millions)	126	335	22
<u>SI Component Expenditures (\$ Millions)</u>			
• Information Systems (Hardware)	34	116	28
• Communications (Hardware)	8	24	25
• Applications Software Packages	3	18	43
• Systems Software Packages	3	15	38
• Consulting Services	7	12	11
• Project Management Fees	7	10	8
• Design/Integration	18	33	13
• Software Development	34	90	21
• Education/Training & Documentation	3	5	11
• Operation and Maintenance	1	2	15
• Other Expenditures	8	10	5
Total SI Expenditures (\$ Millions)	126	335	22

## EXHIBIT C-14

## SYSTEMS INTEGRATION FORECAST DATA BASE FEDERAL GOVERNMENT

Industry Data Element	Market Size 1988	Market Size 1993	CAGR 1988- 1993 (Percent)
Number of Large Establishments	NA	NA	-
Establishments with Major Projects (Percent)	NA	NA	-
Total Major Project Expenditures (\$ Millions)	NA	NA	-
Expenditures Contracted (Percent)	All	All	-
Total SI Contract Value (\$ Millions)	16,650	28,800	12
Total SI Expenditures (\$ Millions)	2,420	5,760	19
<u>SI Component Expenditures (\$ Millions)</u>			
• Information Systems (Hardware)	960	1,880	14
• Communications (Hardware)	173	412	19
• Applications Software Packages	45	143	26
• Systems Software Packages	100	319	26
• Consulting Services	72	210	24
• Project Management Fees	60	185	25
• Design/Integration	220	684	25
• Software Development	605	1,568	21
• Education/Training & Documentation	15	45	25
• Operation and Maintenance	26	83	26
• Other Expenditures	144	231	10
Total SI Expenditures (\$ Millions)	2,420	5,760	19

## EXHIBIT C-15

## SYSTEMS INTEGRATION FORECAST DATA BASE TOTAL ALL INDUSTRIES

Industry Data Element	Market Size 1988	Market Size 1993	CAGR 1988- 1993 (Percent)
Number of Large Establishments*	10,945	12,303	2
Establishments with Major Projects (Percent)*	Avg: 23	Avg: 40	Avg: 12
Total Major Project Expenditures (\$ Millions)*	14,675	30,910	16
Expenditures Contracted (Percent)*	30	47	9
Total SI Contract Value (\$ Millions)	21,065	43,380	16
Total SI Expenditures (\$ Millions)	4,800	14,725	256
<u>SI Component Expenditures (\$ Millions)</u>			
• Information Systems (Hardware)	1,667	4,688	23
• Communications (Hardware)	342	1,202	29
• Applications Software Packages	126	572	35
• Systems Software Packages	160	593	30
• Consulting Services	195	595	25
• Project Management Fees	169	520	25
• Design/Integration	495	1,653	27
• Software Development	1,282	3,956	25
• Education/Training & Documentation	50	165	27
• Operation and Maintenance	50	186	30
• Other Expenditures	265	595	18
Total SI Expenditures (\$ Millions)	4,801	14,725	25

\* Excludes Federal Government

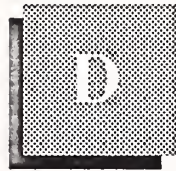




## Appendix: Forecast Data Base Reconciliation







## Appendix: Forecast Data Base Reconciliation

No formal INPUT forecast of the commercial systems integration market by industry sector has been published since the 1986 INPUT report, Commercial Systems Integration Markets, 1986-1991. In order to provide for a comparison, the first year of this 1988 report and the last year of the 1986 report are being used.

In the near term 1988 comparison, only two industries, both government, demonstrate any substantial variance. State and local government projects were tracked in greater detail for the 1988 Industry Sector/Cross-Industry Markets report and uncovered more projects. The major increase in federal government was created by release of several large scale projects delayed by budget actions, as explained in both Sections III and IV. The medical sector expenditures were increased by a number of network and applications projects not identified in the earlier forecast.

The largest decrease for 1988 occurred in the insurance industry, which is slow to accept systems integration as an alternative to in-house development.

The most notable increase in the 1991 forecasts is related to the late 1988 awards of several very large contracts in the federal market, such as the FAA Air Traffic Control Modernization and the IRS Tax System Redesign. The state and local government sector will similarly be affected by several large regional project awards. Increasing demand for cost control and accurate patient records increased medical industry expenditures over the 1986 forecast. None of the remaining positive variances are significant.

The insurance industry accounts for the largest reduction in current views of 1991 prospects, just as it did in the 1988 forecast. Telecommunications is also expected to decline, responding to lower margins and increased customer expense control. Process manufacturing is also predicted to decrease reflecting lower market share and pressure from foreign competitors.

## EXHIBIT D-1

### SYSTEMS INTEGRATION MARKET FORECAST DATA BASE RECONCILIATION BY INDUSTRY SECTOR

Industry Sector	1988 Market Year of Forecast			1991 Market Year of Forecast		
	1986	1988	Var (%)	1986	1988	Var (%)
Banking/Finance	264	230	-34	786	704	-82
Discrete Manufacturing	567	580	+13	1,320	1,329	+9
Insurance	252	125	-127	530	270	-260
Medical	50	160	+110	135	317	+182
Process Manufacturing	169	100	-69	301	197	-104
Retail Distribution*	88	135	+47	281	378	+97
Services	34	30	-4	55	72	+17
State and Local Government	146	380	+234	583	703	+120
Telecommunication	150	125	-25	390	211	-179
Transportation	130	110	-20	200	215	+15
Utilities	171	170	-1	430	394	-36
Wholesale Distribution*	72	110	+38	154	205	+51
Other Industries	40	126	+86	228	227	-1
Federal Government	1,810	2,420	+610	2,710	4,072	+1,362
<b>Total SI Market</b>	<b>3,943</b>	<b>4,801</b>	<b>+858</b>	<b>8,103</b>	<b>9,294</b>	<b>+1,191</b>

Note: In 1986 forecast, retail & wholesale distribution industries combined in same category; 1986 estimate is arbitrarily split.









